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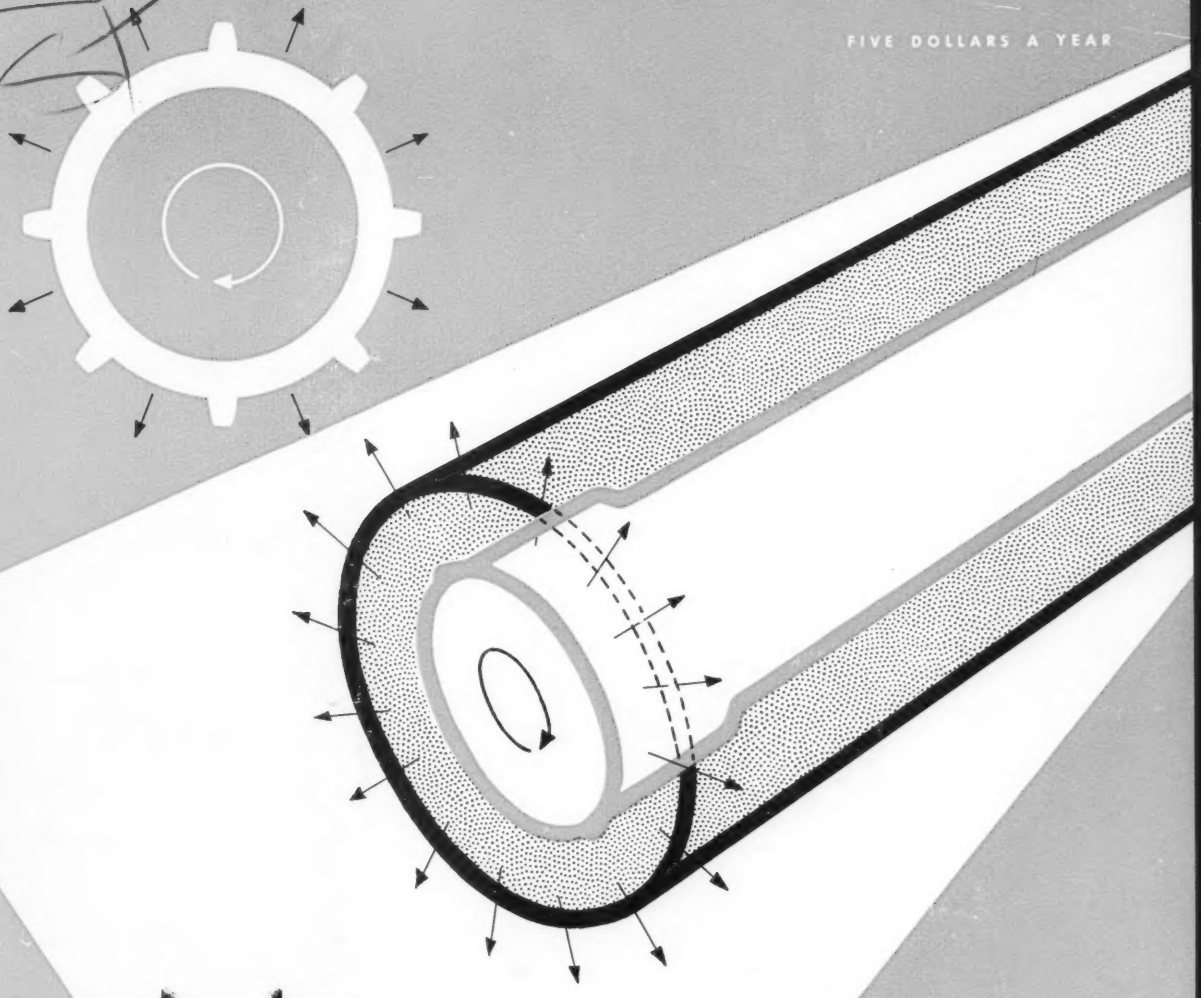
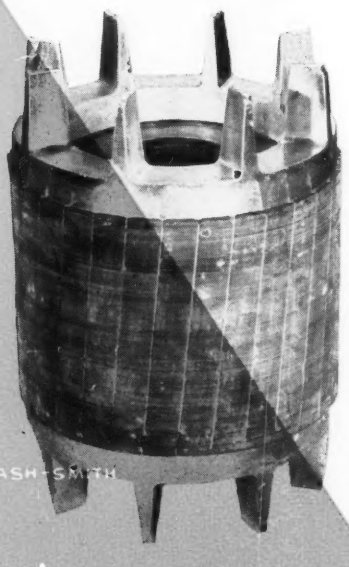




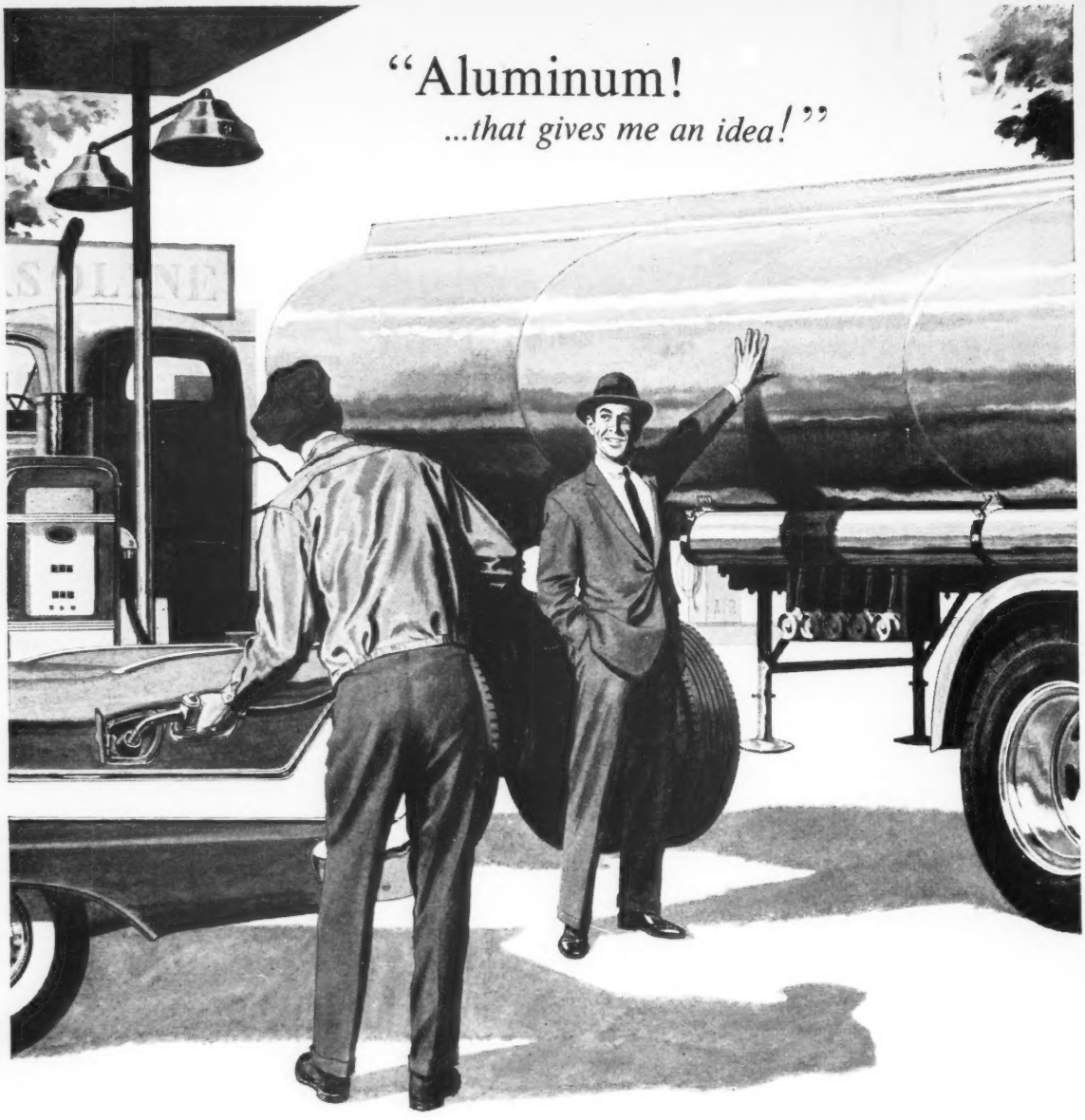
VIVASH-SMITH

OCT 8 1958

October 1958

Centrifugal casting p56
Transistors p60
Nylon applications p45

PUBLISHED BY THE MACLEAN-HUNTER PUBLISHING COMPANY LIMITED, TORONTO, CANADA



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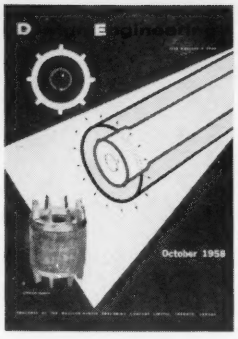

Design Engineering

Vol. 4 **OCTOBER 1958** No. 10

This month's cover

Al Vivash and Eloise Smith make a welcome return to Design Engineering as cover artists for the October issue (they won a design award for the magazine with their February cover). Their artwork spotlights the article on centrifugal casting in the issue.

Design Engineering

MEMBER

CCAB

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Publishers of National magazines in Canada: Maclean's, Chatelaine, Canadian Homes and Gardens. Business newspapers in Canada: Canadian Hotel Review; Fountains in Canada; Heating and Plumbing Engineer; Bus and Truck Transport; Canadian Advertising; Canadian Automotive Trade; Canadian Aviation; Canadian Grocer; Canadian Machinery; Canadian Packaging; Canadian Paint and Varnish; Canadian Printer and Publisher; Canadian Shipping; Canadian Stationer; Civic Administration; Drug Merchandising; Canadian Electronics Engineering; L'Epicier; The Financial Post; Hardware and Metal; Marketing; Men's Wear; Modern Power; Painting and Decorating; Plant Administration; Le Quincaillier; Electrical Contractor; Style; Office Equipment & Methods; Home Goods Retailing; Photo Trade; Le Pharmacien; Building Supply Dealer. Business newspapers in U. S. and U. K.: Inland Printer, Rock Products, Concrete Products, British Printer.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal; The Burrard Building, 1030 West Georgia Street, Vancouver 5; Maclean-Hunter Limited, 125 Strand, London (Eng.) Maclean-Hunter Publishing Company Ltd., Auf den Haefen 12, Bremen, Germany.

Subscription rates: Canada $5.00 per year, two years $9.00, three years $13.00. Single copy price, $1.00. United States and Great Britain $10.00 per year. Other countries $20.00 per year.

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Du Pont of Canada launches a new era in Canadian Plastics . . .

with the immediate start in construction of its new St. Clair River Works near Sarnia, Ontario—an ultra-modern, automated plant which will manufacture revolutionary linear polyethylene resins for the Canadian market. In addition, nearing completion this fall, is a $300,000 plastics sales service laboratory at Kingston, Ontario, designed for research into the development of the linear polyethylene production process—and the future consumer applications.

Linear polyethylenes are an amazing new family of resins with hitherto unmatched properties. They are vastly stiffer, stronger and harder than plastic products made from the familiar conventional types of polyethylene, with outstanding proven resistance to heat, chemicals, abrasion and vapor transmission.

The young lady from Du Pont, above, is demonstrating only some of the variety of plastic articles which will be made from linear polyethylenes to benefit Canadians in the years to come. The products range from bottles which can safely be immersed in boiling water to rigid and high-gloss bowls, utility baskets, semi-rigid water and chemical piping, lab utensils and high tenacity rope.

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EGGLETON

Faintly reminiscent of Von Stroheim in the shot at the left is **Larry Eggleton,** author of October's article on transistors. Eggleton is no stranger to the editorial pages of Design Engineering, having been a contributor before. A widely traveled man, he has been to Malaya and India in the services and South America and the West Indies in civilian life. A member of the Society of Technical Writers and Editors and the Canadian Industrial Editors Association, he is with Aviation Electric in Montreal.

*

HARVEY

SIMBECK

WIESNER

The trio of co-authors above are the men responsible for this month's graphite article. All three of them are with the Speer Carbon Company in St. Marys down in Pennsylvania.

Ives L. Harvey is a graduate of Juniata College and joined Speer in 1946. His most recent appointment was to the sales managership of the carbon products division of the company.

Leo F. Simbeck has been with Speer since 1942, with time spent in the U. S. infantry as a laboratory technician. He graduated from Pennsylvania State University in 1950 with a B.S. in engineering and has risen since then to his present position of senior application engineer with his company.

Francis Wiesner joined Speer after graduation from high school and is now their chief plant engineer. He is responsible for the design of carbon and graphite specialties and the development of manufacturing methods.

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Reports

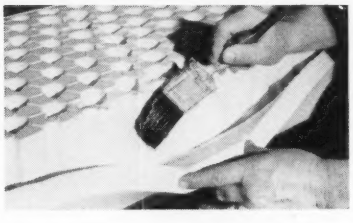
A news roundup of items of engineering and design interest from the world over

Aircraft hangar scales less than half a ton

Not shown to the best advantage in our photograph is the new type of portable aircraft hangar. It can be raised or dismantled in under half an hour and is capable of holding an aircraft with a 40-ft. wing span: the first has just been put into service on a small airport in the U. K.

Having a light alloy framework which is self-supporting and requires no main poles or guy ropes, the covering is of polyurethane-proofed nylon sheeting and the total weight of this portable hangar is only half a ton. Our picture shows the hangar with the front section raised to admit a Westland "Whirlwind" helicopter.

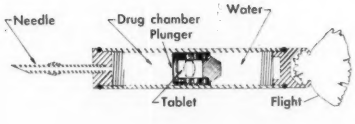
Better bond with less adhesive in foam fabrication



An American company has developed a foam splicing adhesive which incorporates a synthetic polymer that contributes unusual spread characteristics to the product.

Seemingly, this new adhesive will get around many of the problems generally associated with working with foamed products as follows: extremely thin glue may be applied without detrimental effect on the bond strength, there's a greater yield-per-gallon, production speed is increased due to the faster "grab" and one of the most serious hazards in foam cushion manufacture, dimpling, is avoided.

Animals get their knockout drops from a gun

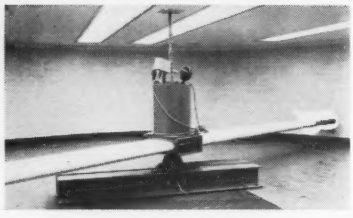


Putting a curb on wild animals, cattle (or for that matter, humans) should be safe and easy with this device released in the U. S. It is a flying syringe which can be fired from a special gun and injects nicotine in the body of its target as soon as it strikes home. This has a stunning effect of up to 30 minutes. The propulsive force for injecting the nicotine is carbon dioxide gas, formed when a tablet dissolves in water as the gun is fired. The syringes vary in size from 2 to 6 inches in length depending on the animal to be laid low.

This may take his headlights out of your eyes

One of the big gripes coming from traffic safety authorities centres on the problem of misaligned automobile headlights. The problem has been aggravated in the last couple of years by the decision of most auto manufacturers to switch to dual lamps. Supposedly aligned at the end of the production line, many cars nevertheless hit the highways with their head lamps seemingly adjusted any old way. Oldsmobile is currently using a new headlamp alignment system for which super accuracy is claimed. An additional advantage of the system is the fact that it permits the lamp adjustment floor space to be reduced from the normally required 25 ft to 7 ft. Large dials, easily readable to 0.004°, permit the operator to know not only the direction of adjustment, but the amount required.

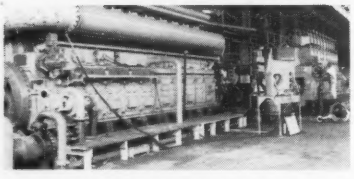
Centrifuge simulates forces on a missile during flight



High acceleration, simulating actual flight conditions, can be applied to missile guidance systems and components on this 32-foot diameter centrifuge. The unit undergoing test is mounted on the end of the boom (far right). The drive motor is under the steel grating in the foreground.

The forces which the centrifuge duplicates are those of sustained axial acceleration during take-off and climb, and pitch and yaw during direction changes. Note the twin spotlights and television camera atop the unit: these are focused on the unit while under test.

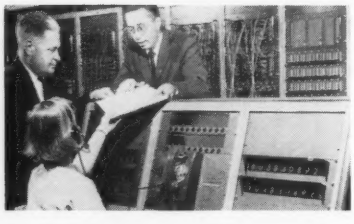
Biggest Canadian-made spark ignition gas engines go west



The largest spark ignition gas engines ever built in Canada will be installed in Trans-Canada Gas Pipelines' first station at Burstal at the Alberta-Saskatchewan border.

These ten-cylinder engines are 30 feet long, 12 feet high and weigh 120 tons. They will be used to drive natural gas through the pipeline. Each engine develops 3,500 hp (at 330 rpm). The engines were built in Quebec by Dominion Engineering Works Ltd.

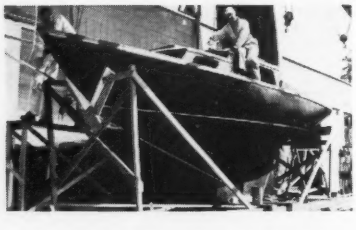
Mechanized oracle listens in and then forecasts



This is Sibyl, a computer-like machine from the Bell Telephone Laboratories which may help the company to predict the desires of future telephone customers.

Linked to a telephone, the "oracle" would collect information on how the call was placed—such as the date, time, originator, speed of operation, errors, whether the line was busy or the call completed and so forth. The data would also answer questions such as whether certain people are error-prone. A word of comfort to the user—Sibyl won't tattle on your telephone conversations.

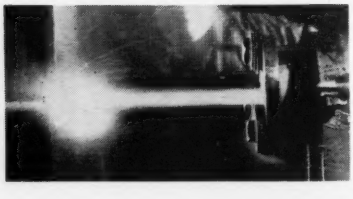
Molded glass fibre yacht has the color in its shell



A new boat to be seen in British Columbia waters anytime now is this 28-ft. Brandlmayr-designed yacht. It is creating considerable interest due to the fact that its hull is of molded Fiberglas construction.

The hull is molded in one piece in a female mold to include a hollow keel in which the 1,500 lb lead ballast keel and the water and gas tanks are located. The shell ranges in thickness from 1 in. at the points of greatest stress to 5/16 in. and has a high glass to resin ratio. The boat's black color is impregnated into the shell.

Materials to stand 5,000F for longer periods



In a jet of exhaust gases traveling at five times the speed of sound from an oxygen-kerosene flame (note characteristic supersonic nodes), the conical specimen being studied here reaches a white heat of approximately 5000 deg F in a matter of seconds. Conventional graphite erodes beyond tolerable limits in about 8 seconds, but the Union Carbide organization has already produced material that holds dimensions ten times longer, and has its sights on even longer cycles, well beyond the normal operating requirements of rocket engine components.

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Mr. Felix Aimonetti, Vice President and General Manager of Link Aeronautical states: "The use of POLYLITE polyester resin as a laminating agent helps make this Douglas DC-8 training cockpit a rigid, durable, realistic structure, with a surface that resists corrosion and is easily painted. Our experience with POLYLITE resin has continued to impress us with the high quality of laminating it performs."

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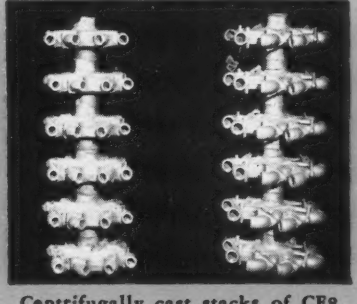
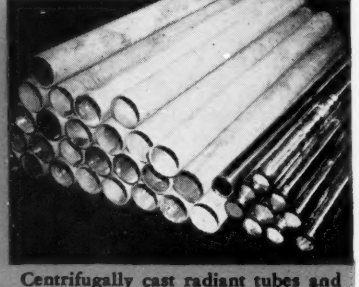


Centrifugally cast stacks of CF8 fittings (as cast condition).

Centrifugally cast HU retorts for magnesium production.



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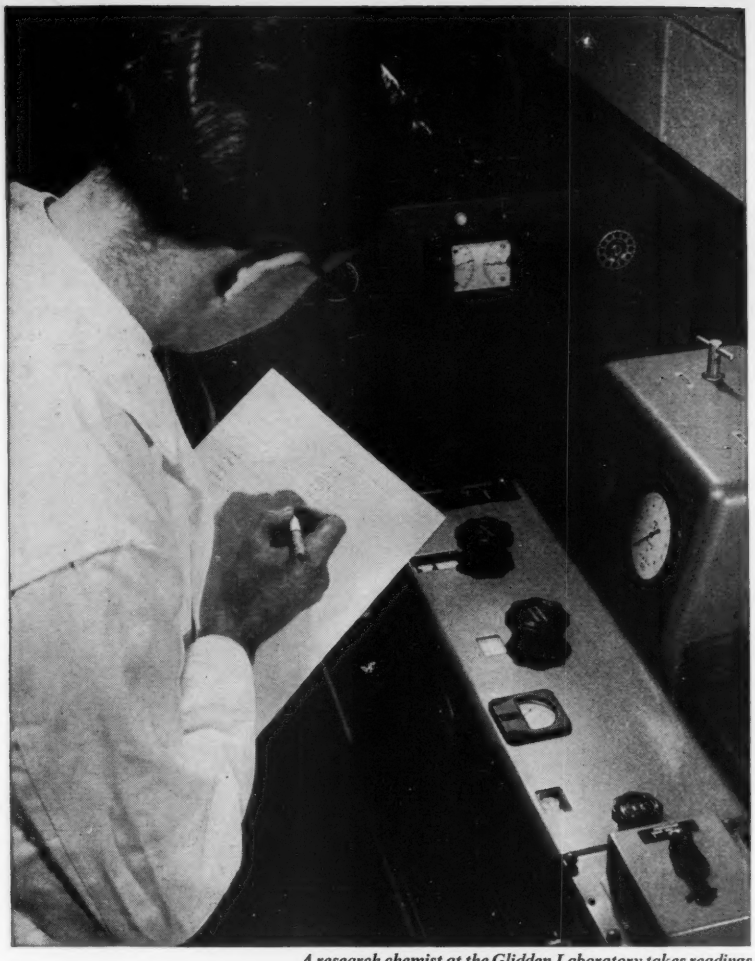

A research chemist at the Glidden Laboratory takes readings from the electronic Spectrophotometer—a very sensitive instrument for measuring color.

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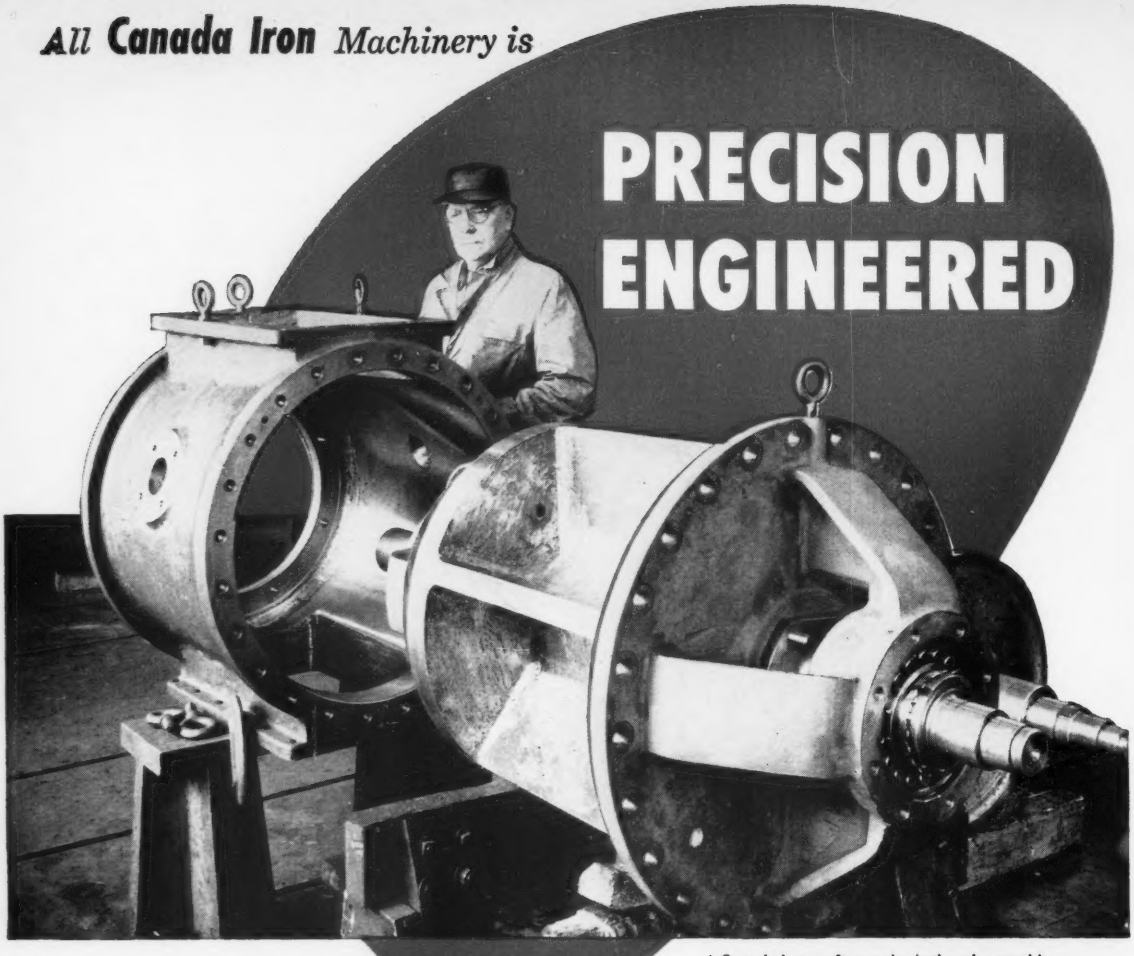

A Canada Iron craftsman checks the sub assembly of a housing and rotor, part of an air pressure feeder for the pulp and paper industry. Very close tolerances are essential before assembly. The unit's total weight is 7,400 lbs.

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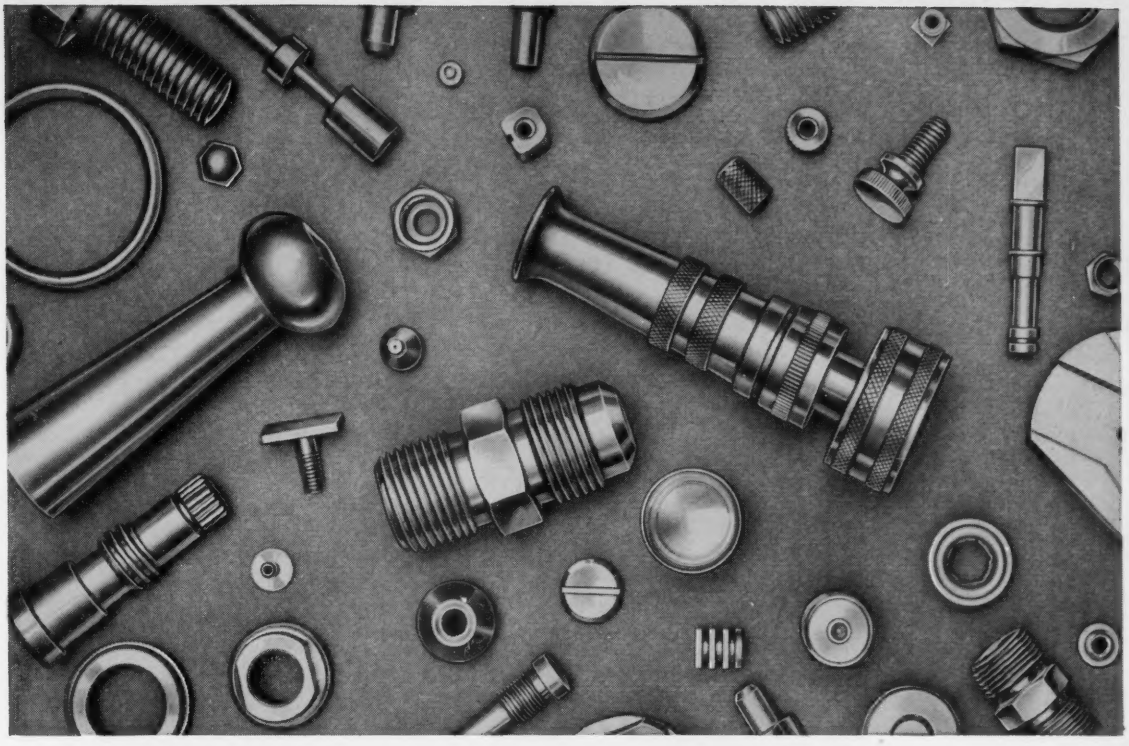

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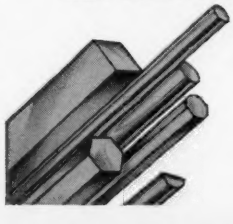

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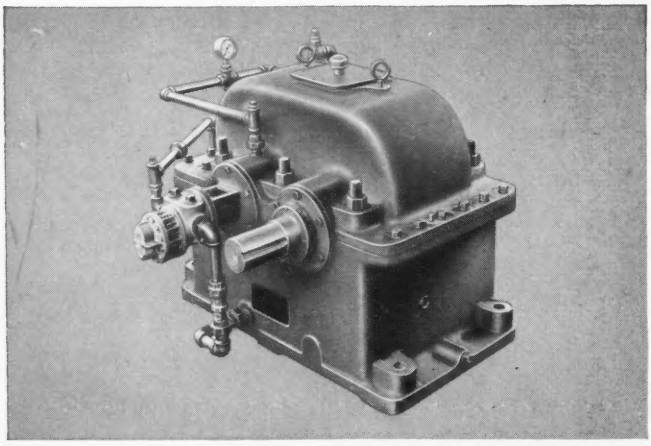

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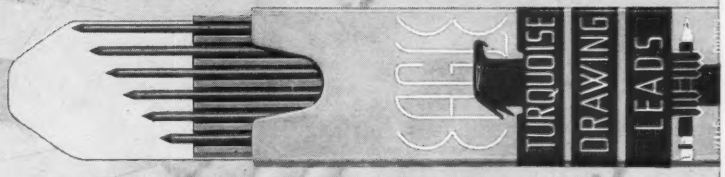


• **TURQUOISE DRAWING LEADS:** Fit any standard holder. Grades 5B through 9H.

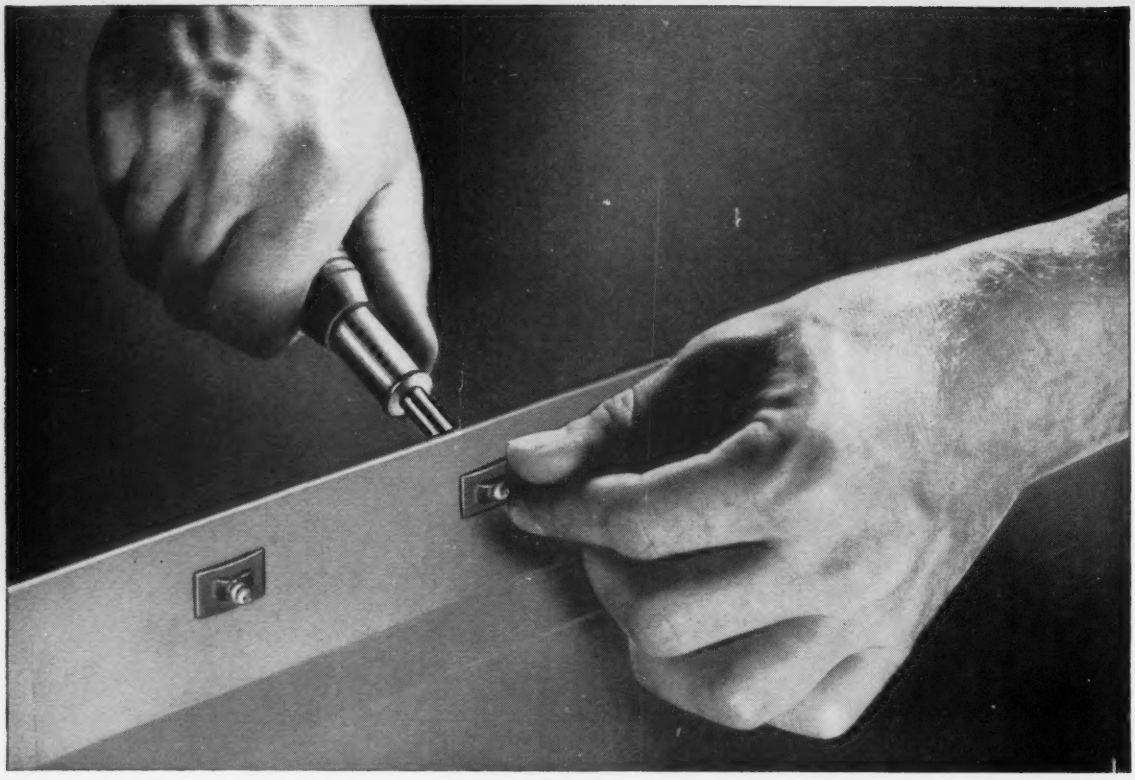
• **TURQUOISE LEAD HOLDERS:** Hold any grade of Turquoise lead—so firmly that lead cannot be pressed back.

EAGLE TURQUOISE

PENCILS, LEADS AND HOLDERS

are the largest-selling in the United States and Canada!

EAGLE PENCIL COMPANY · NEW YORK · LONDON · TORONTO · MEXICO · SYDNEY · BOGOTA



These hands are your biggest investment

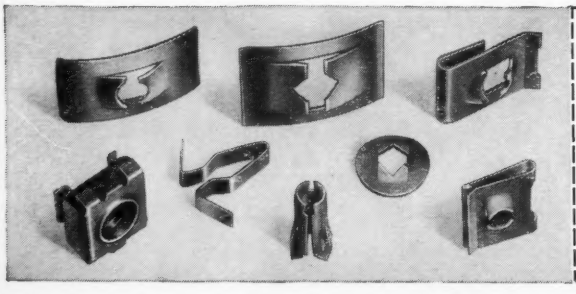
...they'll do better work faster with

Speed Nut®

FASTENERS

Manufactured in Canada

In even the most mechanized plant, there is still a good deal of hand assembly to be done. It's vital to your profits that these hand operations be done quickly and expertly with no waste motions. To be sure that your big investment in these hands is paying a good return, look into Speed Nut Fasteners. These modern efficient fastening devices are cutting costs for thousands of leading manufacturers throughout the world. Mail this coupon today for complete information.



33-5802

DOMINION FASTENERS LIMITED

a **Geo. A. Tinnerman** *corporation*

HAMILTON, ONTARIO. Branches: Toronto, Montreal.

Exclusive Licensee for Tinnerman Products Inc., Cleveland, Ohio.

Please send me complete information on how Speed Nut Fasteners can reduce my costs and improve my product.

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TITLE_____

COMPANY_____

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WE MANUFACTURE_____

DOMITE * CASTINGS

mean better service, economy

When you think of castings, think of DOMITE. These castings save you money; their exacting production for your specific need means a longer life of top service. DOMITE Castings comply with A.S.T.M. specifications. Careful selection is made from a wide range of Canada Iron casting grades to do the *best* job for you. Ask your Canada Iron representative today about DOMITE.

Canada Iron manufactures all grades and types of cast iron, for convenience classified as follows and complying fully with A.S.T.M. A48 where applicable. Here are some typical examples:

DOMITE "30": Better than average cast iron. Minimum tensile strength 30,000 psi. Typical Brinell hardness 200.

DOMITE "40": High strength, medium cross-section. Minimum tensile strength 40,000 psi. Typical Brinell hardness 235.

DOMITE "50": High strength, heavy cross-section. Minimum tensile strength 50,000 psi. Typical Brinell hardness 260.

DOMITE WEAR RESISTING: Type WR—A, B, C and D (type depending on service involved).

DOMITE HEAT RESISTING: Type HR—A, B, C and S (type depending on service involved).

NI-HARD: Alloyed white iron, Brinell 550-650

NI-RESIST: High nickel alloy cast irons for corrosion and heat resistance. Tensile strength 25,000 to 30,000 psi, Brinell 130-180.

DUCTILE NI-RESIST: Composition and properties as for Ni-Resist, but with 60,000 psi tensile strength and 10% elongation, strong and shock resistant.

NODULOY, DUCTILE IRON: Nodular or ductile cast iron in a complete range of properties, from 60,000 psi tensile and 20% elongation at 160 Brinell to 180,000 psi tensile at 330 Brinell. Available also in special heat resistant grades.

**Trade Mark Registered*

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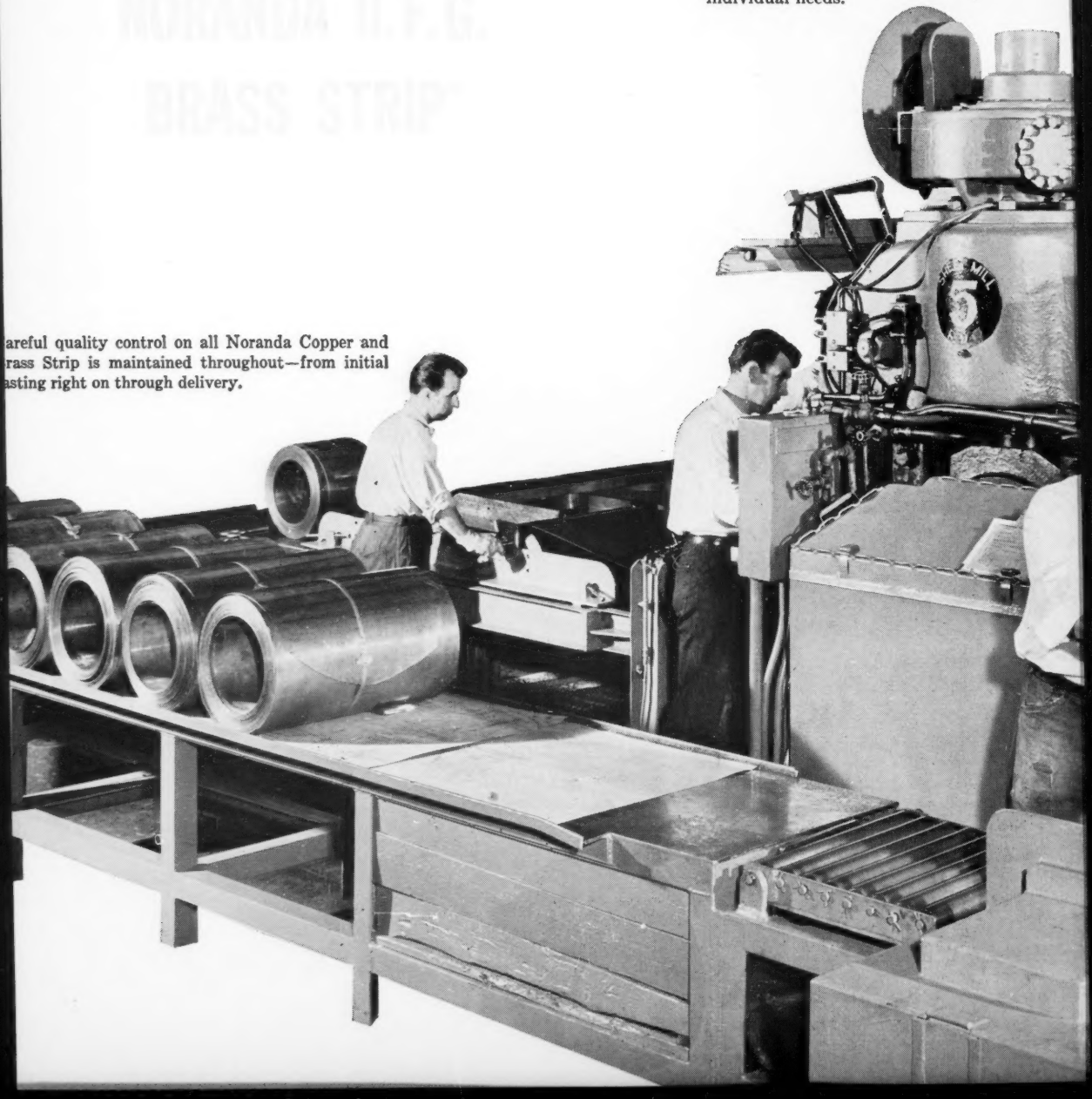
FOR QUALITY PRODUCTS AT REDUCED COSTS USE POPULAR-PRICED NORANDA U.F.G. BRASS STRIP

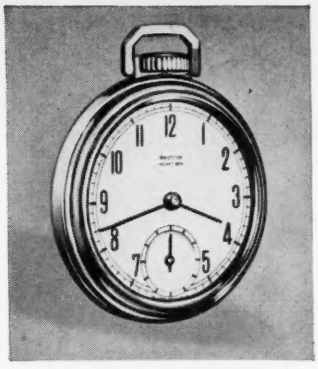
Noranda *Ultra-Fine-Grain Brass Strip offers these three features—an absolute minimum of polishing, ability to take a fine plated finish and most important, low price—a combination of advantages that adds up to better quality at lower cost.

Noranda Ultra-Fine-Grain Strip is fabricated to meet your forming needs *exactly*. It is readily formed, stamped and shallow-pressed; and its fine grain structure presents a surface so smooth and even that most finishes require only a color buff.

To get the complete story, SEE THE MAN FROM NORANDA. Our Technical Service Representatives will be pleased to assist you in the selection of correct grain size and temper to suit your individual needs.



areful quality control on all Noranda Copper and rass Strip is maintained throughout—from initial asting right on through delivery.



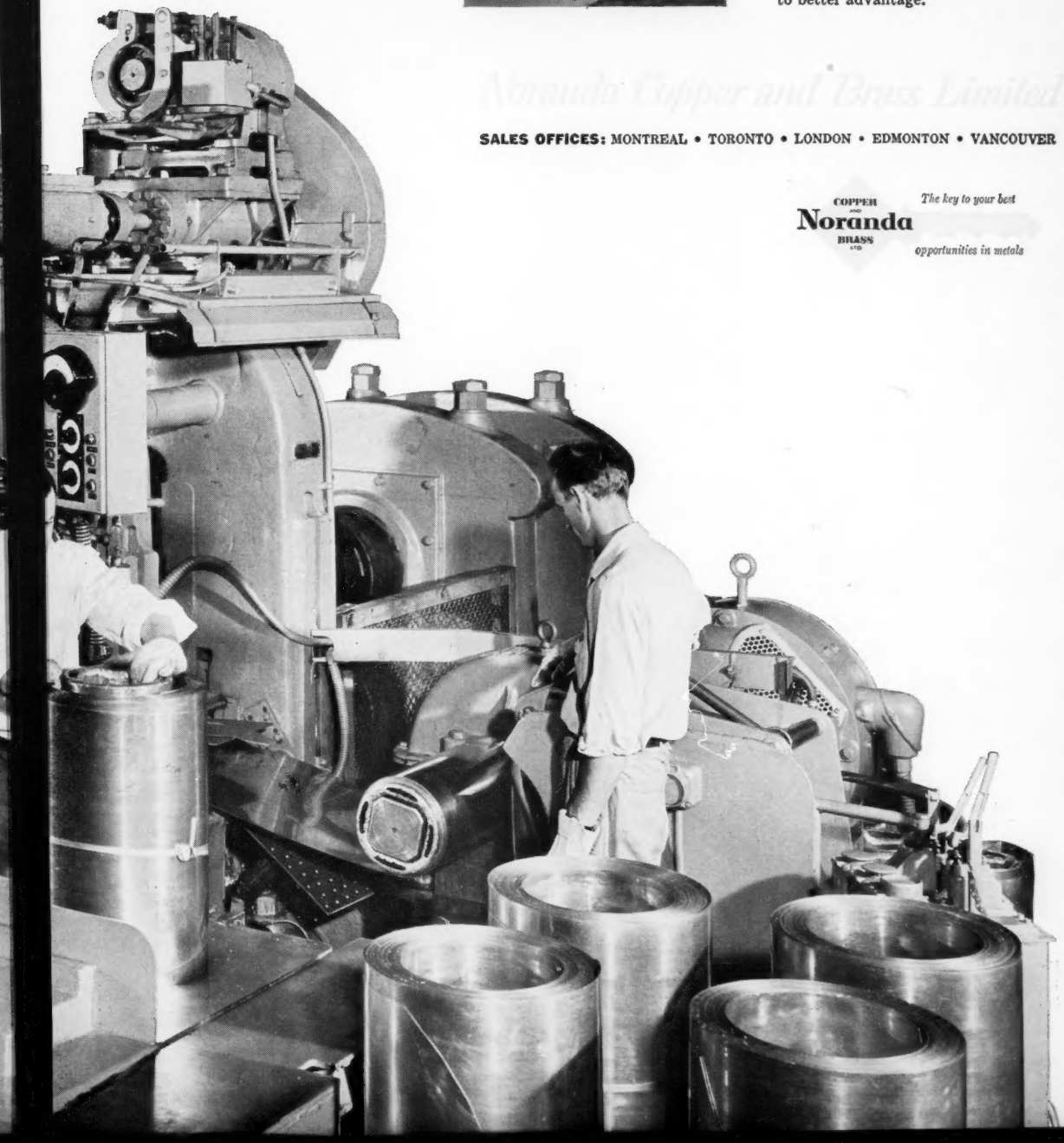
Plated U.F.G. beauty is apparent in these fine products. Case of the Westclox Pocket Ben by Western Clock Company, Ltd., and fishing lures by Lucky Strike Bait Works Ltd. are outstanding examples of low-cost fine finishes obtained with U.F.G. Brass Strip.

Noranda makes an extensive range of copper and brass strip and sheet to meet a wide variety of drawing, spinning, stamping and engineering applications. Because so many different characteristics can be "built into" copper alloys you can meet almost any product or production requirement with ease. Regardless of the material you are now using, it will pay you to discuss your strip and sheet needs with the Man From Noranda... chances are he can show you new ways to use copper alloys to better advantage.

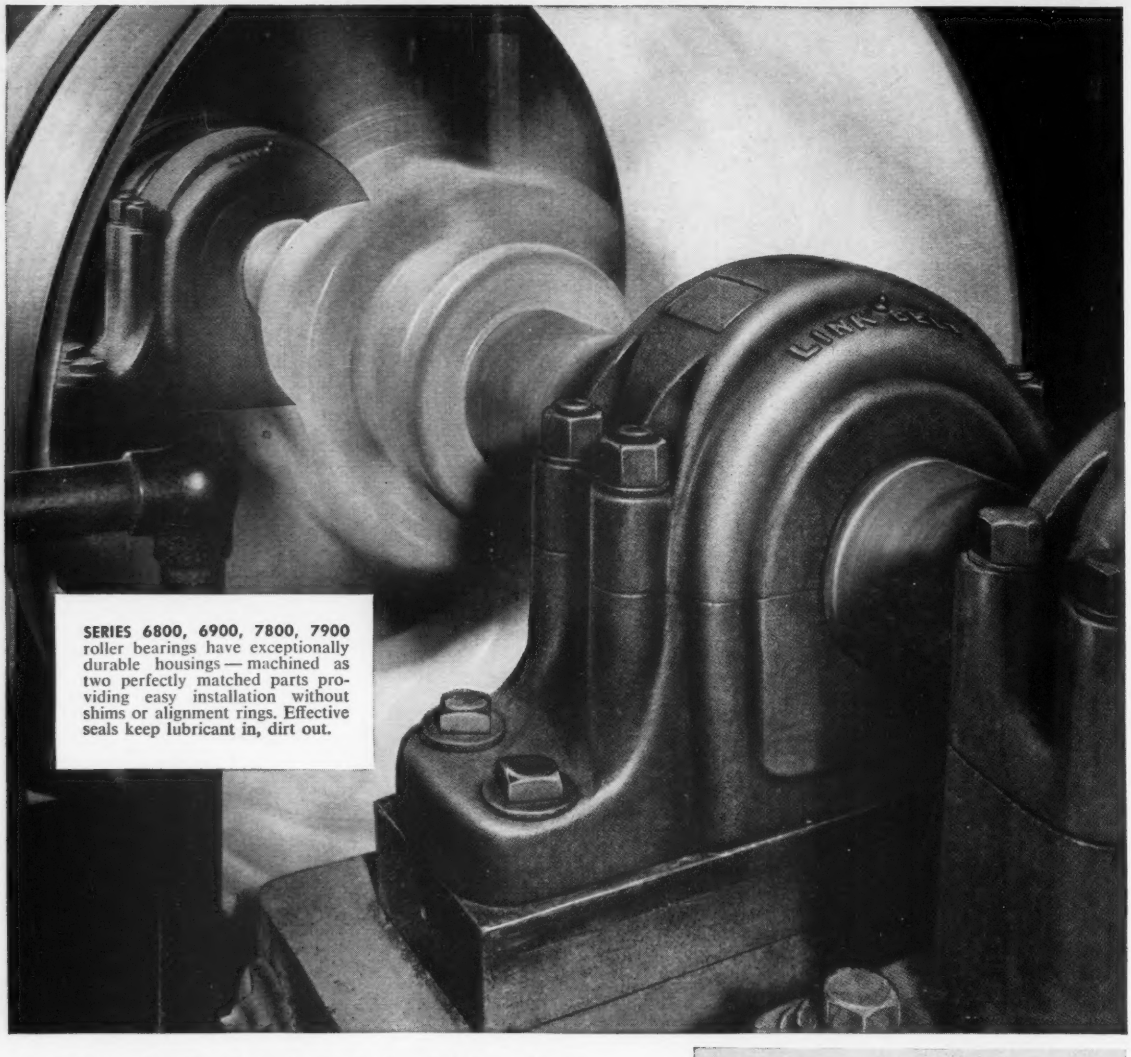
Noranda Copper and Brass Limited

SALES OFFICES: MONTREAL • TORONTO • LONDON • EDMONTON • VANCOUVER

COPPER AND BRASS LTD. **Noranda** *The key to your best opportunities in metals*



NO PINCH, NO BIND-- ALWAYS-ALIGNED

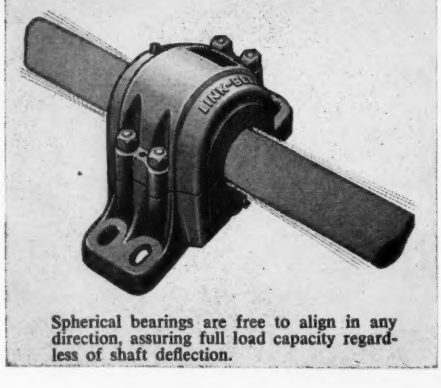


SERIES 6800, 6900, 7800, 7900 roller bearings have exceptionally durable housings — machined as two perfectly matched parts providing easy installation without shims or alignment rings. Effective seals keep lubricant in, dirt out.

These husky bearings in husky housings adjust *instantly* to shaft misalignment

Shaft deflection often means quick failure for ordinary bearings . . . but not for these rugged Link-Belt *self-aligning* bearings. Adjusting immediately in any direction, they easily compensate for misalignment . . . avoid damaging "pinch" and bind.

You can get full information on Link-Belt's complete bearing line from any one of the Link-Belt offices. Or contact your authorized stock-carrying distributor.



Spherical bearings are free to align in any direction, assuring full load capacity regardless of shaft deflection.

LINK-BELT

MANUFACTURERS OF SELF-ALIGNING BALL AND ROLLER BEARINGS

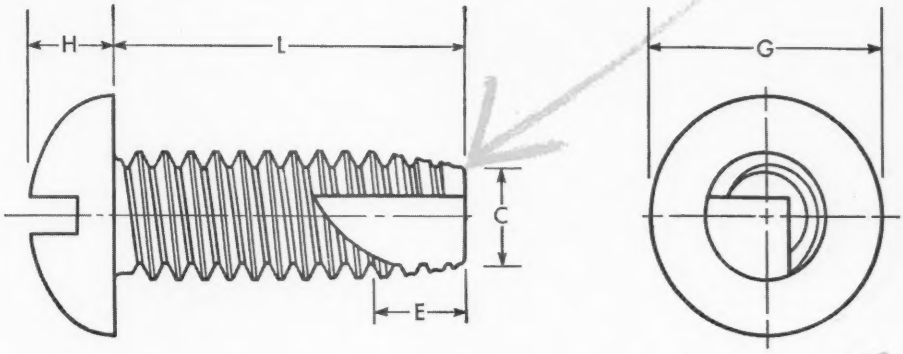
LINK-BELT LIMITED: Scarboro Plant, General Offices and District Sales—1960 Eglinton Avenue, E., Scarboro, Ont., Station H, Toronto 13 • Eastern Avenue Plant and Factory Branch Store—731 Eastern Avenue, Toronto 8 • Sales Offices and Factory Branch Stores—Montreal 15: 945 Beaumont Avenue • Vancouver 12: 2550 Boundary Road • Winnipeg 10: 1315 Portage Avenue • Swastika, Ont.: 8 Boisvert Street • Halifax: Austen Bros. Ltd., 118 Hollis Street • District Sales Offices—Hamilton: 605 James Street, N. • Edmonton: 10019—103rd Street • Sydney: Austen Bros. Ltd., 361 George Street • Foundry at Elmira, Ont., 19 Church Street, E.

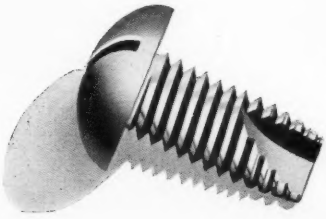
14,905-C

THREAD-CUTTING SCREWS

TYPE 23

ELIMINATES TAPPING—
CUTS COST 33%





GET TESTING SAMPLES FROM

FUNCTION: SHAKEPROOF Type 23 Thread-Cutting Screws cut perfectly mated threads in metal, die castings and plastics.

VARIATIONS: Type 1 Thread Cutting Screw has narrow slot and standard thread for certain hard metal applications; Type 25 for plastics has spaced thread and large cutting slot.

SPECIAL FEATURES: Pilot points, enamel-reaming points, double-end studs, headed shoulders. Thread-Cutting Screws can be pre-assembled with lock washers, fiber washers, flat washers, special stampings. Sealing compounds available.

HEAT TREATMENT: Special heat treating makes SHAKEPROOF Thread-Cutting Screws twice as strong as ordinary screws, often reduces the number or size of screws required.

REMARKS: Thread-Cutting screws reduce fastening cost as much as ½ by eliminating tapping operation. Ideal for use with automatic hopper-fed power screw drivers.

HEAD STYLES: All popular styles available including slotted, Phillips recess, hexagon and hexagon washer heads. Many special heads.

MATERIALS: Steel, stainless steel, aluminum, brass.

FINISHES: Cadmium plated, plain, parkerized or other finishes as specified.

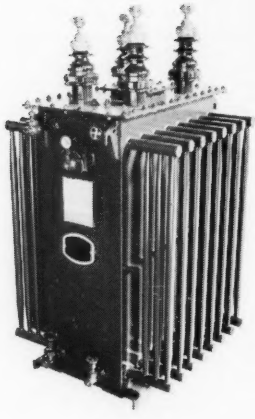
DRAWN BY:		CHECKED BY:	
RDC	1/1/58	RMW	1/1/58

NOTE: Type 1 and Type 23 Thread-Cutting Screws cut a standard machine screw thread, can be removed and reused. Patented.

SHAKEPROOF/FASTEX

DIVISION OF CANADA ILLINOIS TOOLS LTD.

67 SCARSDALE ROAD · DON MILLS, ONTARIO



FROM TRICYCLES TO TRANSFORMERS

Standard Tube supplies the tubing!

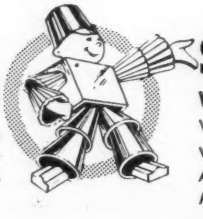
COMPLETE TUBING FACILITIES

DESIGN AND TECHNICAL ASSISTANCE

QUALITY CONTROL

. . . . . .

Standard Tube, the largest fabricator of welded steel tubing in Canada, is ready to give *you* a complete tubing service from single tubes to complicated fabrications. To ensure constant high-quality tubing, Standard Tube maintains a completely equipped laboratory to make continuous product tests . . . ranging from raw stock analysis to searching examination of in-use operation of finished units. If you are designing new products or improving existing ones, let Standard Tube work with you.



STANDARD TUBE STANDS FOR ALUMINUM TOO!

Sheet, Bar, Extrusions, Tube and Wire—available in any quantity.

Write or phone for immediate service

STANDARD TUBE AND T. I. LIMITED

WOODSTOCK • HAMILTON • TORONTO • OTTAWA • MONTREAL

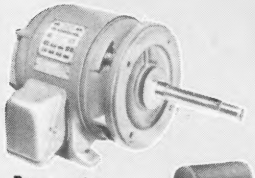
VANCOUVER REPRESENTATIVE: NESCO ALUMINUM LTD.

WELDED AND SEAMLESS STEEL TUBING • FABRICATIONS • ALUMINUM • MATERIALS HANDLING EQUIPMENT • SCHOOL AND NESTING FURNITURE

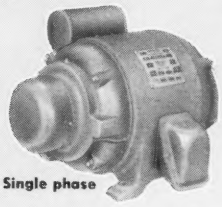
Member of Formed Steel Tube Institute

H 7564

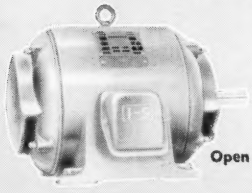
Totally enclosed fan cooled



Pump motor



Single phase



Open drip-proof

SINCE 1904

BROOK ELECTRIC MOTORS

OF CANADA LIMITED

BROOK ELECTRIC MOTORS OF CANADA LIMITED
250 University Avenue Toronto, Ontario

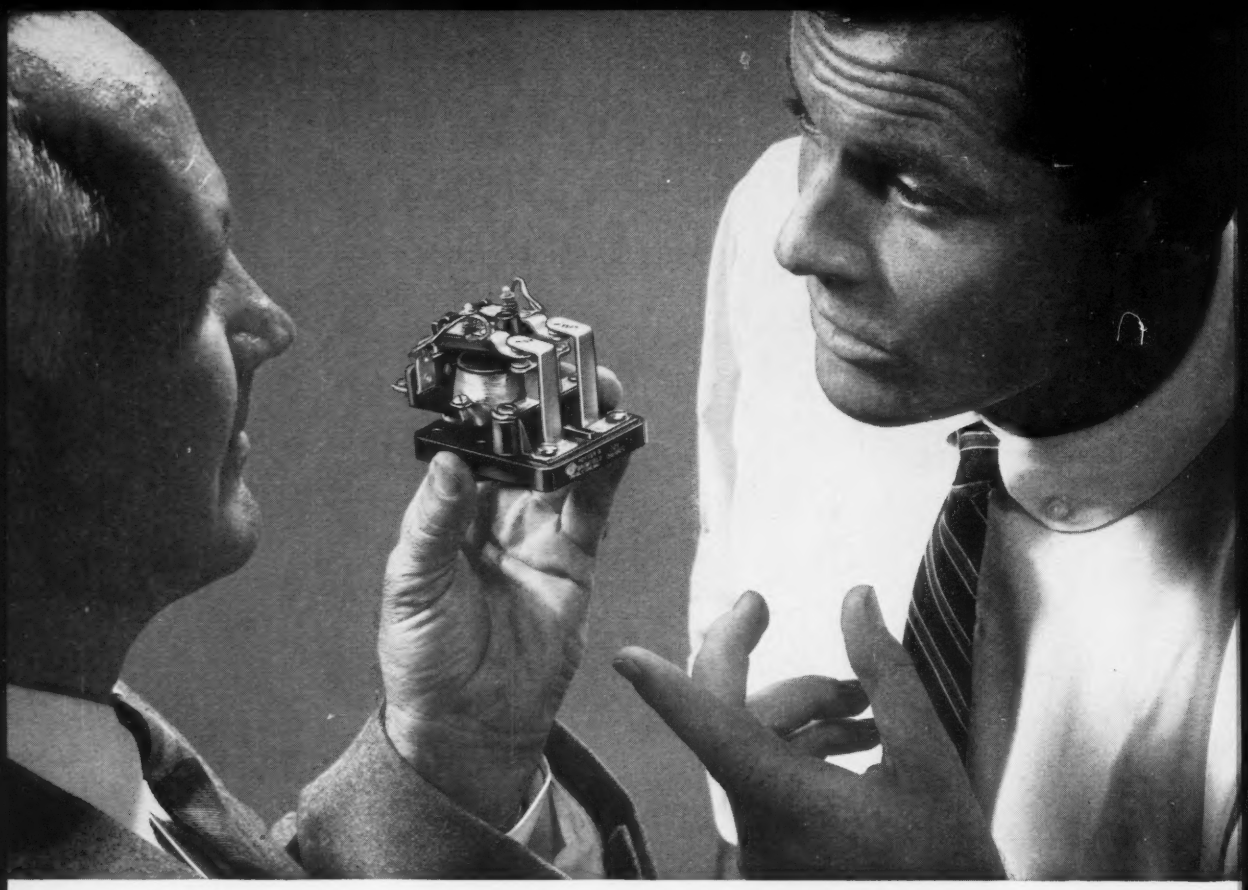
To serve you better!

BROOK MOTORS

the world's most respected motor, opens Canadian office

For years Canada has been numbered among Brook Motors Limited best customers and now to ensure fast delivery and prompt service at all times, a Canadian office is being opened.

Brook Motors are built better to last longer. Constructed to meet or surpass CEMA standards and approved by CSA. Specially designed to resist moisture, oil, dust, heat. Sizes to 600 h.p. Send today for literature.



HERE'S WHY P&B's PR POWER RELAY IS PREFERRED

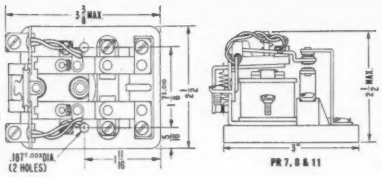
for high current/voltage switching

HEAVY DUTY construction means long-term dependability when switching up to 20 amperes (double break contacts). Here is a ruggedly built relay, packed with high quality features, yet economically priced.

The PR's full floating movable contact carrier, for example, provides excellent contact pressure and ample wipe for self-cleaning contact action. The coil is centrifugally impregnated with top-grade varnish to eliminate moisture traps.

Contact arrangements up to DPDT are available. The PR has been adapted for printed circuitry and heavy duty plug-in applications.

All standard AC actuated PR relays may carry the UL and Canadian Standards Association seals of approval. Write or call for complete information.



GENERAL SPECIFICATIONS:

Breakdown Voltage: 1500 volts rms min. between all elements and ground.

Ambient Temperature: DC: −55° to +85°C.
AC: −55° to +55°C.

Terminals: Heavy duty screw type. Standard printed circuit pins or plug-in on request.

Enclosures: PR dust cover.

CONTACTS:

Arrangements: Up to 2 Form C (DPDT).

Material: 5/16" dia. silver or silver cadmium oxide. (Others available)

Load: Single break: 15 amps; Double break: 20 amps at 115 volts 60 cycle AC resistive.

AUXILIARY CONTACTS:

Arrangements: 1 Form A, B or C.

Material: 3/16" diameter silver

Rating: 5 amps at 115 volts 60 cycle AC resistive.

COILS:

Resistance: 64,000 ohms maximum.

Power: 1.8 watts DC; 9.8 volt-amps AC.

Duty: Continuous AC or DC (DC coils will withstand 1 watts at 25°C).

Insulation: Centrifugally impregnated with high quali varnish.

Mountings: 2 holes .187" diameter 1⅞" o.c.

PR Relays Approved By Underwriters' Laboratories and Canadian Standards Association

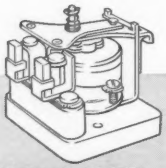
Type	Contact Arrangement*	Type	Contact Arrangement
PR1AY	SPST-NO	PR5AY	SPDT
PR2AY	SPST-NC	PR7AY	DPST-NO
PR3AY	SPDT-NO-DM	PR8AY	DPST-NC
PR4AY	SPDT-NC-DB	PR11AY	DPDT

These relays are available in any of the followin operating voltages: 6, 12, 24, 48, 115, 208, 230, or 44 volts 50/60 cycles AC.

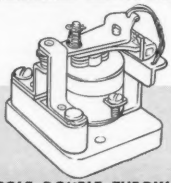
The contacts are rated at: 13 amps, 115 volts AC. 6. amps, 230 volts AC. 1 hp for 115 or 230 volt AC motor Any relays deviating electrically or physically from thes standard models will not carry U/L or CSA approval.

*Read: NO normally open, NC normally closed, D double break, DM double make.

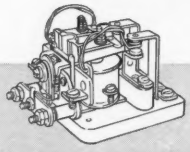
P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR



PR RELAY WITH MAGNETIC BLOW-OUTS
Models PR3 and PR7 can be supplied with alnico magnets to suppress arcs on DC loads over 1200 watts.



SINGLE POLE DOUBLE THROW VERSION
PR 5 (SPDT) has all the heavy-duty features of other models in this series.

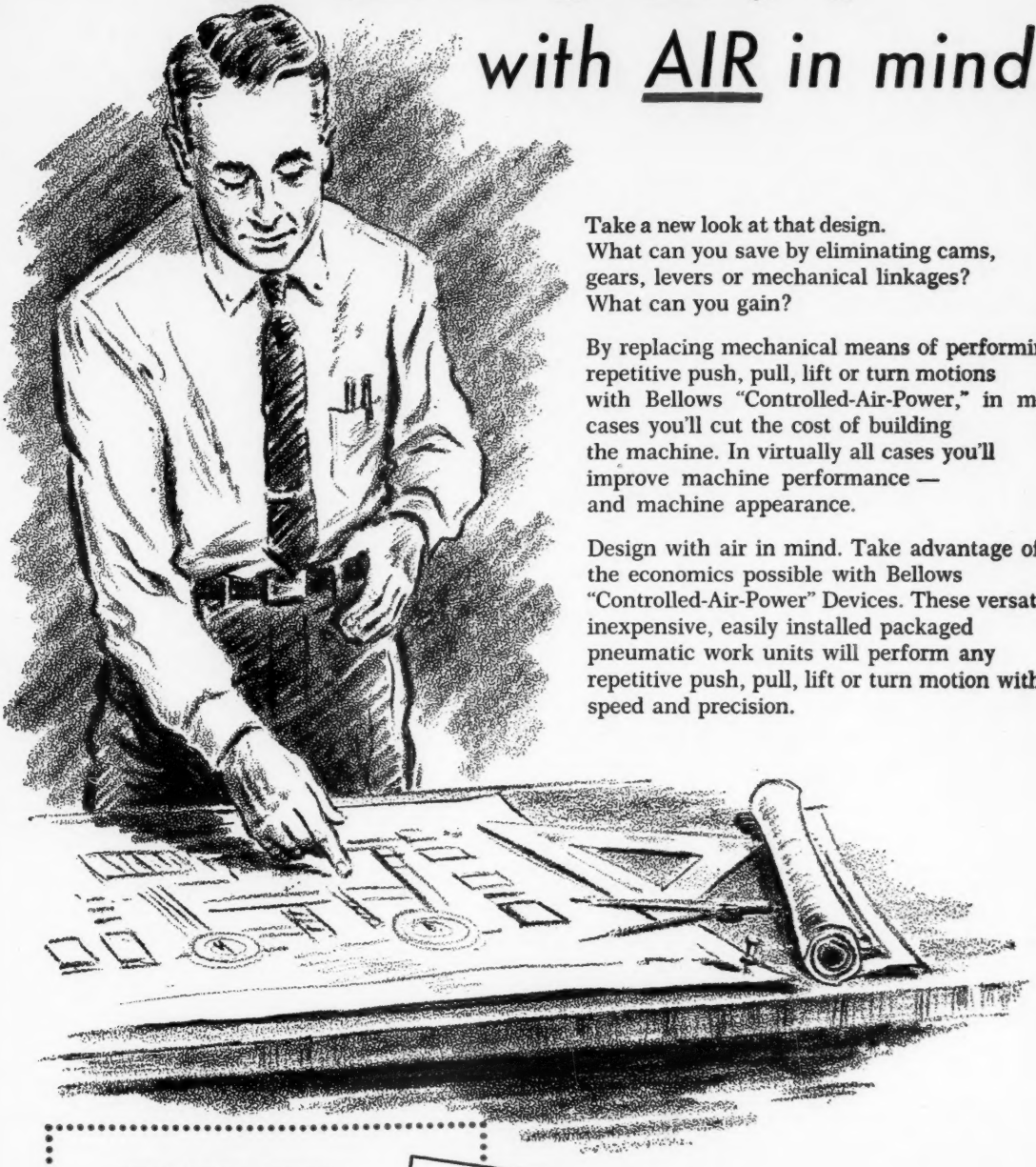


PR WITH AUXILIARY CONTACTS
All PR models can be equipped with auxilliary contacts in 1 Form A, B, or C arrangements.

AMF **POTTER & BRUMFIELD** CANADA LTD
Guelph, Ontario

DESIGN

with AIR in mind



Take a new look at that design.
What can you save by eliminating cams, gears, levers or mechanical linkages?
What can you gain?

By replacing mechanical means of performing repetitive push, pull, lift or turn motions with Bellows "Controlled-Air-Power," in most cases you'll cut the cost of building the machine. In virtually all cases you'll improve machine performance — and machine appearance.

Design with air in mind. Take advantage of the economics possible with Bellows "Controlled-Air-Power" Devices. These versatile, inexpensive, easily installed packaged pneumatic work units will perform any repetitive push, pull, lift or turn motion with speed and precision.

READ THIS STORY—

"The Place of the Bellows Air Motor in Original Equipment Design."

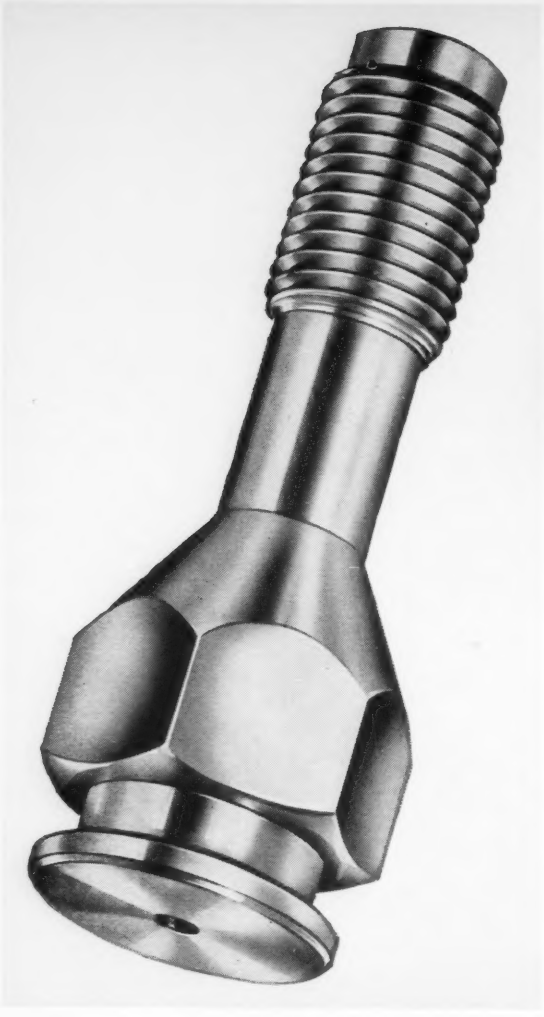
This new 14 page booklet will be of help to any design engineer.

Write Dept. DE 1058, Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ontario.

Bellows

PNEUMATIC DEVICES OF CANADA, LTD.
14 Advance Road *Toronto, Canada*

893-B



CUT PRODUCTION COSTS!

Here is an excellent example of how a leading Canadian Manufacturer reduced his overall production costs by having certain components made by the Screw Machine Division of the Weatherhead Company. The manufacturer not only saved money on the components but also valuable man hours and machine time. Production of the project was therefore accelerated—result, greater production, lower overall cost.

Weatherhead produces thousands of precision-made components, such as this, in the million quantities, for Canada's major manufacturing industries. Our manufacturing "know-how" in producing components made from brass, steel, aluminum, nylon and other materials may change the profit picture of your end product.

Our sales representative can tell you how economically we can produce any quantity, small or large. We welcome your enquiry. Send in blueprints, specifications or samples for quotation. Address your enquiries to Dept. SM, The Weatherhead Company of Canada Ltd., St. Thomas, Ontario.

THE MARK OF QUALITY

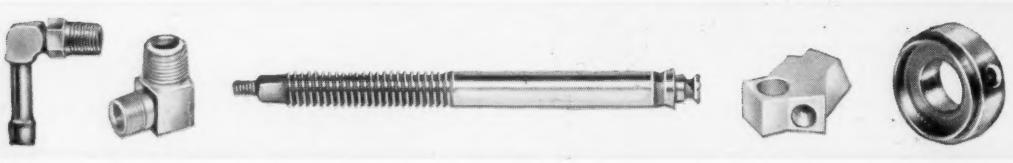
WEATHERHEAD

SCREW MACHINE DIVISION

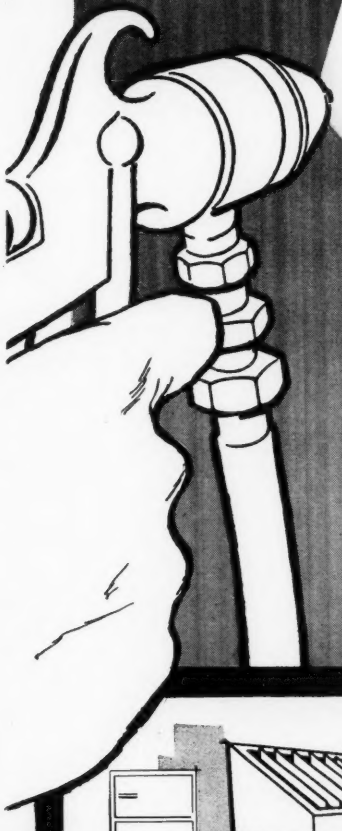
St. Thomas, Ontario

Here are a few of thousands of parts produced for leading Canadian manufacturers.

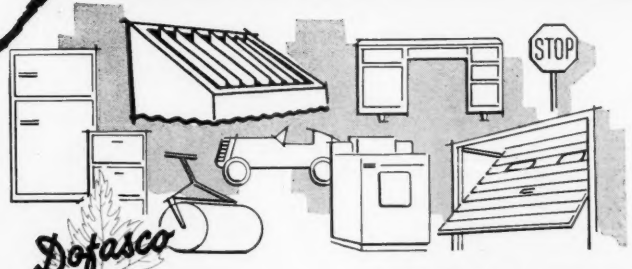
SM-2-8-2C



you get a smooth paint finish with POSITIVE ADHERENCE... on DOFASCO satincoat



satincoat is made to be painted! Enamels, lacquers and paint take to **satincoat** and they stay on . . . without expensive and time-consuming surface preparation. **satincoat** resists rust . . . the ductile zinc-coating is bonded tightly to the steel, it actually flexes with the base metal. You save time in manufacturing—and your products will stand up to years of service without chipping or scaling.



Dofasco

Canada's Pioneering Steel Plant

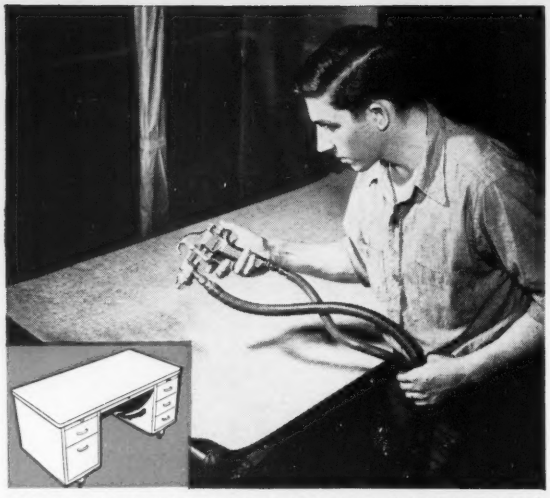
If you make it with steel—you'll make it better with satincoat! There's nothing like *steel* for sturdy, long-lasting service. And only **satincoat** gives complete protection from paint-scaling rust. To learn how **satincoat** will cut your costs—and help you make a better product—contact Dofasco or your local steel jobber.

Any stamping oils, greases, etc., picked up during processing will, of course, need to be removed before paint is applied. This is ordinary painting procedure regardless of the material used.

DOMINION FOUNDRIES AND STEEL LIMITED, HAMILTON, CANADA

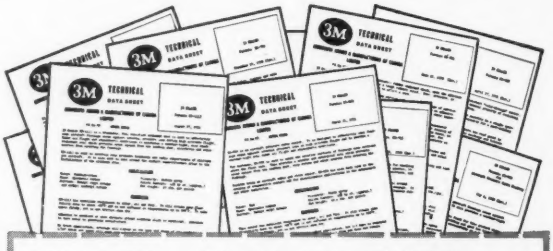
23-5304

TRANE CO. OF CANADA LTD. SAVES TIME insulating air conditioners by using specially designed 3M Adhesives. These adhesives hold the insulation tightly to the metal. No drying time is needed. The insulation never comes loose.



OFFICE SPECIALTY MFG. CO. LTD. SAVES COSTS in production by using another specially designed 3M Adhesive. Every desk they make has its top laminated with 3M Adhesive. Speed of application and holding power are just two of the reasons.

CONCRETE PIPE LIMITED SAVES LEAKS by using rubber gaskets adhered tightly to concrete by a 3M Adhesive. The combination of the adhesive and gasket defies the elements.



Minnesota Mining and Manufacturing of Canada Limited,
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YOU SAVE when you utilize the latest developments in industrial adhesives. Investigate this exciting field for new production methods. Write for full details on the complete range of 3M Adhesives.

PRODUCTS OF 3M COMPANY RESEARCH → **with**

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VIBRAMIX is a premixed compound of Vibrin and reinforcing material — glass, sisal, asbestos or others, plus filler and colour as required.

VIBRAMIX is easily formed by compression or transfer molding at medium pressures and heats.

VIBRAMIX may improve products by replacing other plastics, metals, wood and ceramics.

VIBRAMIX simplifies assemblies and eliminates many finishing operations.

Please Weigh These Special Features:

Good heat stability • Good dimensional stability • Excellent electrical properties • Excellent flow properties • Elimination of glass preforming, resin mixing, preheating and curing • Short molding cycles • Use of standard compression and transfer molding machines and techniques.

Molding Principles

Mold Temperature: 290° – 300°F.
Mold Pressure: 1000 – 2000 p.s.i.

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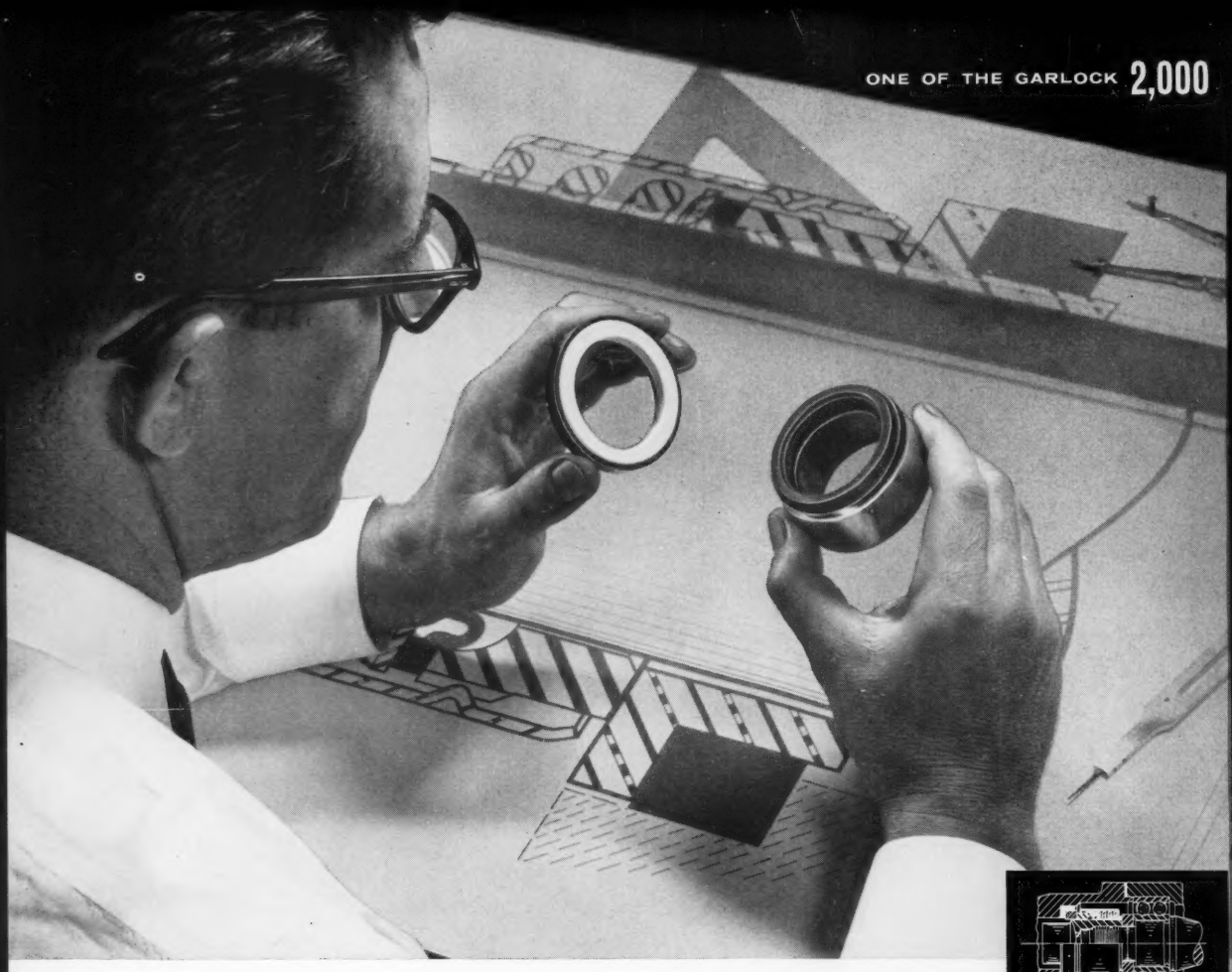


GARLOCK Package Mechanical Seal Eliminates Leakage, Prevents Shaft Wear

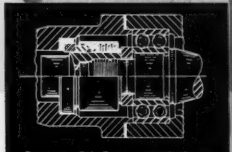
Completely self-contained, the Garlock PK seal is simple to install and offers long, care-free service against water, oils, alcohol, mild acids, and solvents . . . against temperatures to 212° F., pressures to 150 psi, and shaft speeds to 2000 fpm.

ELIMINATE LEAKAGE. On Garlock's PK MECHANIPAK,* the sealing faces of the rotating and stationary parts are precision lapped for perfect contact, thus assuring leak-proof sealing.

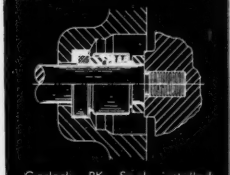
ELIMINATE SHAFT WEAR. There are no parts of the Garlock PK MECHANIPAK seal that move on the shaft or the sleeve, thus removing the danger of scoring and wear.

CUT DOWNTIME, MAINTENANCE. Once the Garlock PK MECHANIPAK seal is applied, no further adjustments are necessary. Life is equal to many sets of conventional packing.

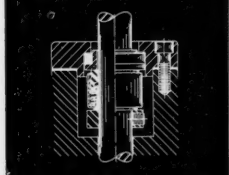
USED ON A HUNDRED AND ONE JOBS. Pumps, speed reducers, automatic washers, commercial dishwashers, disposal units, and construction equipment are just a few examples of where you can apply Garlock MECHANIPAK seals. They're another part of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for every need. The only complete line. That's why you get unbiased recommendations from your Garlock representative. Call him today or write for MECHANIPAK Catalog AD-150.



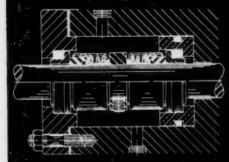
Garlock PK Seal installed on shaft for retaining lubricant in bearing.



Garlock PK Seal installed against impeller of centrifugal pump.



Garlock PK Seal installed on vertical pump shaft.



Double Garlock PK Seal installation on horizontal agitator shaft.

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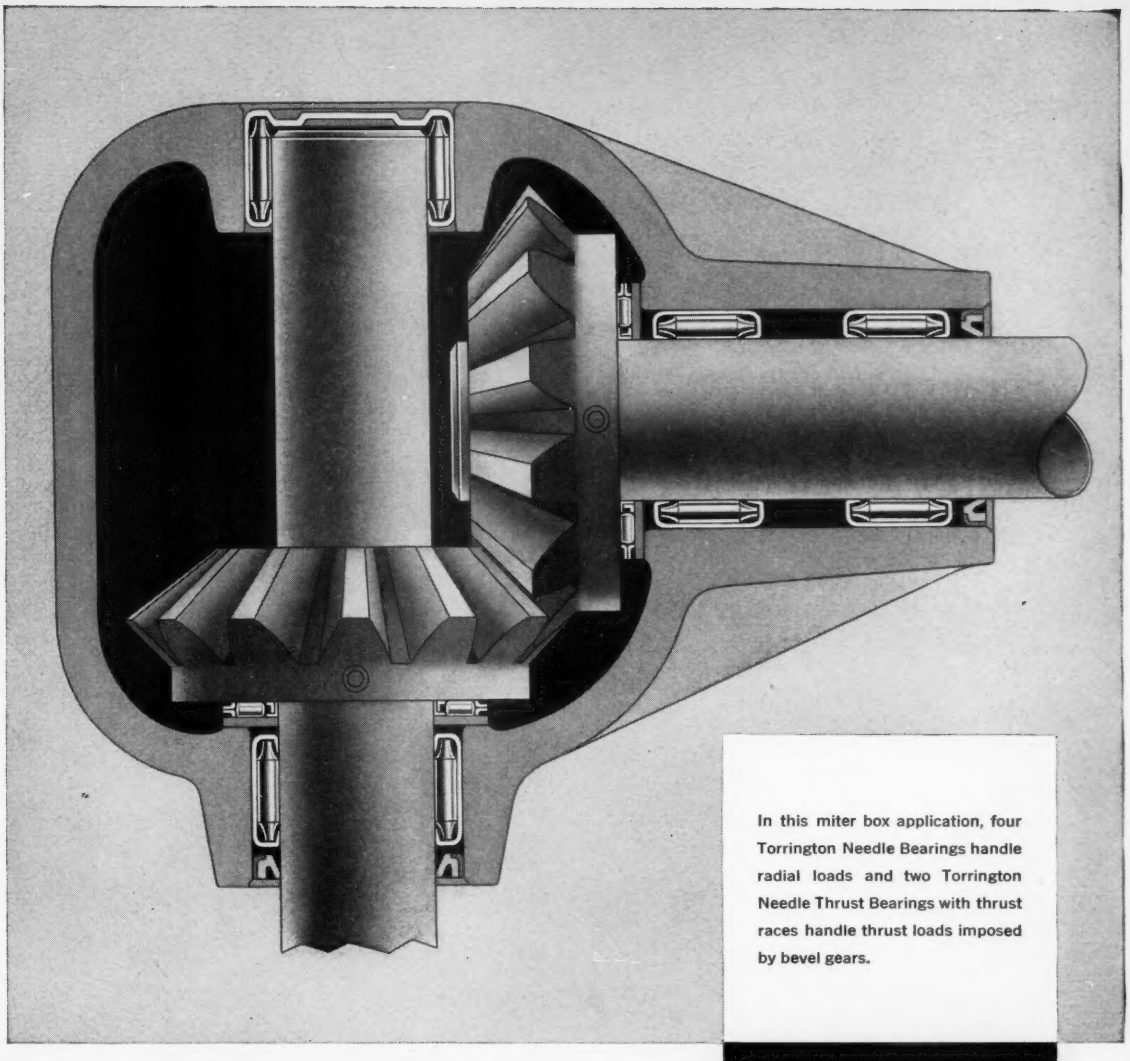
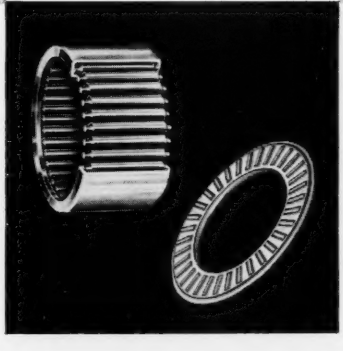


In this miter box application, four Torrington Needle Bearings handle radial loads and two Torrington Needle Thrust Bearings with thrust races handle thrust loads imposed by bevel gears.

Perfect Combination for Thrust and Radial Loads



Here's a space-saving, cost-saving way to handle high thrust and radial loads. Just team up Torrington Needle Bearings with Torrington Needle Thrust Bearings!

With their full complement of small diameter rollers, Needle Bearings handle higher radial loads than any other anti-friction bearing of comparable cross section. And Needle Thrust Bearings are only .0781" thick – as thin as an ordinary thrust washer. Together they make a perfect combination of compact, light, rugged anti-friction bearings.

Either type of bearing may be run on hardened and ground adjacent parts to meet minimum space requirements. Or they may be used with standard races available from Torrington. To make the most of this efficient combination, call on our engineering staff for application advice. **The Torrington Company, Limited, 925 Millwood Road, Toronto 17, Ont., Canada.**

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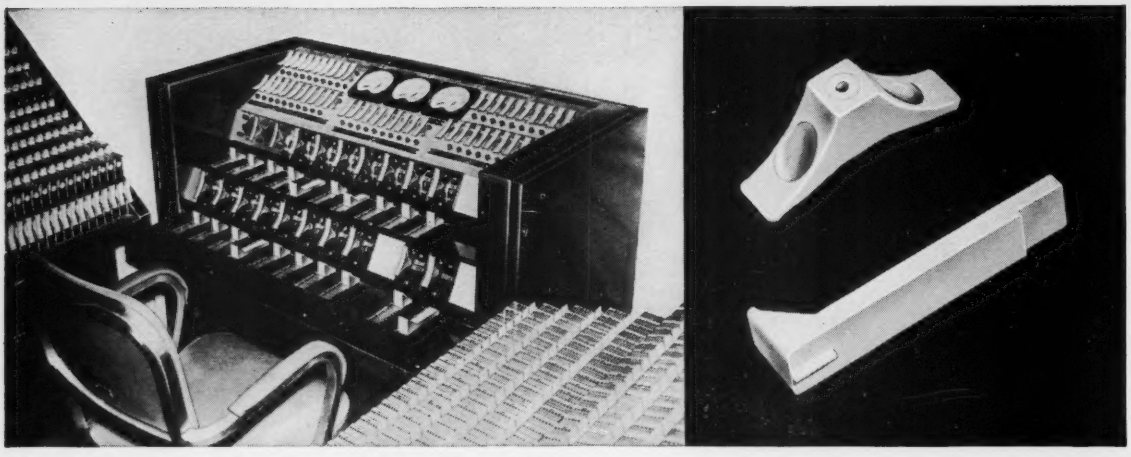

Plastic Keys Conduct an Orchestra of Light

One operator can play infinite variations in stage-lighting effects on the plastic "keys" of the Lumitron Lighting Control System. Control handles and slide bars are molded of BEETLE® urea plastic, an excellent dielectric which requires no insulation. Permanent, molded-in colors permit quick circuit identification. Developed by Metropolitan Electric Manufacturing Company, the Lumitron has an excellent record of performance.

"Five-in-One" Counter-Top Appliance Features CYMEL® Plastic Accessories

The new multipurpose NuTone Food Center operates a mixer, blender, meat grinder, knife sharpener and fruit juicer from one motor that can be set flush in a counter top Counter clutter, tangles of electric cords and heavy separate appliances are eliminated. A gleaming white 3½-quart bowl made of CYMEL melamine molding compound serves the mixer and juicer. CYMEL makes the bowl lightweight, dent-proof and easy to handle. The bowl is molded for NuTone, Inc., by Prolon Plastics Division of Prophylactic Brush Co.

New Insulated Beverage Set Joins Growing List of Boilable CYMAC® Housewares

Suitable equally for hot or cold beverages, these new double-shelled Thermo-Serve tumblers and pitchers are molded of CYMAC 201 methylstyrene, Cyanamid's new heat-resistant thermoplastic. This CYMAC ware resists staining by fruit acids, coffee and other beverages, and can be washed in boiling hot water, even in automatic dishwashers, without cracking or warping. All parts are injection-molded by NFC Engineering Company and sealed together under heat.

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this newest form of packaging... plus... complete range of spool sizes

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The facilities of Canada's most modern magnet wire plant now make it possible for Canada Wire to supply your requirements in this newest and most convenient form of packaging, *in addition* to a complete range of spool sizes. "Pail-Paks" and "Barrel-Paks," the latter in both full and half sizes offer great advantages. Fully protect wire against dust and damage. Greatly reduce volume of handling in your plant. Eliminate much of the time now wasted in changing spools.

INSIDE—BETTER MAGNET WIRE THAN EVER

Made at a plant engineered from the ground up to produce the finest and most uniform quality magnet wires modern technology can create. The *only* magnet wire plant in Canada with facilities for storing 30,000 gallons of wire coating enamels, eliminating the variations formerly found from batch to batch in using drum-type shipments. Completely air conditioned to remove all dust that might contaminate enamel insulation. Automatic production that assures minimum handling.

WIDEST RANGE — Choice of 54 kinds of insulation to meet the most exacting operating requirements. Thicknesses from No. 9 to No. 50. NOTE—contact your nearest Canada Wire sales office for details of sizes available in Barrel-Paks and Pail-Paks.

Canada Wire and Cable Company Limited

A *Canadian* company manufacturing and selling coast to coast

At the Brussels' Fair IBM's Ramac presents World History in 10 languages with the help of Skinner Solenoid Valves

Visitors to the World's Fair at Brussels are given the opportunity to submit history questions to IBM's Ramac and get their answers in any one of ten languages. Millions have been fascinated by this amazing electronic data processing machine.

Ramac is a vast library of facts. By means of 50 rotating metal disks 5,000,000 alphamerical characters can be stored and selected at the touch of a button. The Ramac can punch 100 cards a minute, transfer data from punch cards to disks at a rate of 125 cards per minute, and print reports at speeds up to 80 lines per minute.

Three Skinner V5 three-way valves are used in the access control mechanism. One valve engages the access arm at the exact location of the disk, while the second valve disengages the arm after the read-write sequence has been completed. The third valve positions the read-write head at the precise location on the proper disk tract.

Skinner has a wide selection of solenoid valves for all types of applications. If you have a control problem, why not take it to a Skinner engineer or representative. You will find Skinner representatives listed in the Yellow Pages or write direct to Department 350.

Your Skinner distributor in Canada is listed below:

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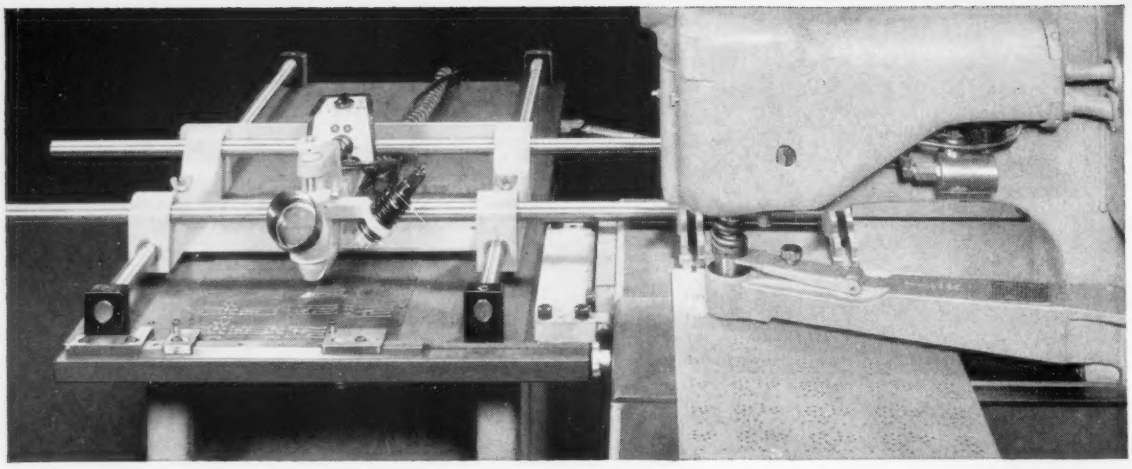
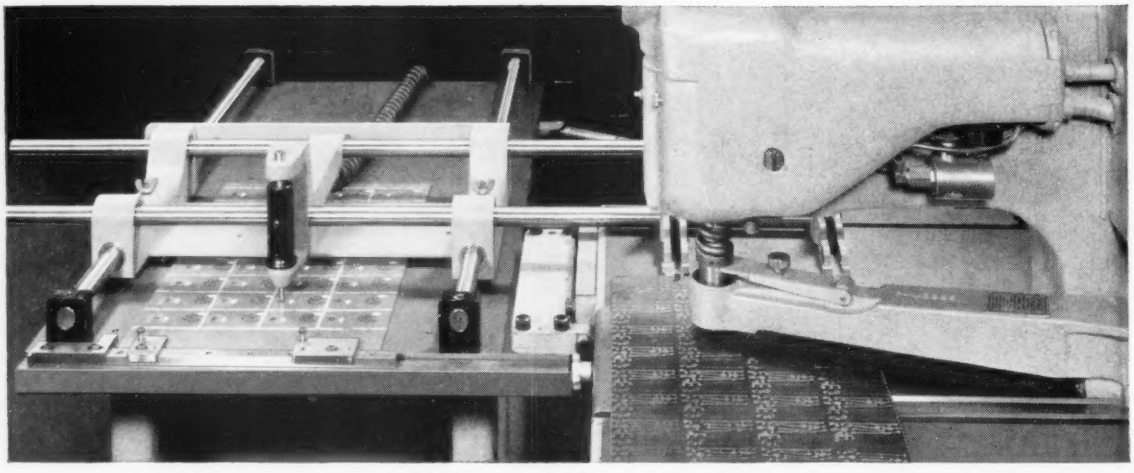


a faster way to **cold-punch** printed circuits



The DUPL-O-SCOPE

Firms punching and notching printed circuit boards — or any sheets up to ¼" mild steel — know how profitable it is with a Strippit Fabricator-Duplicator. Now, it's even faster with the new Dupl-O-Scope, which eliminates the template drilling and layout step!

Readily mounted in the Duplicator stylus bracket, this precision optical pickup device quickly translates a drawing, layout or printed circuit sample into a punched metal template — ready for rapid-fire cold punching and notching on the Fabricator-Duplicator using standard interchangeable tools or "specials" made up to your requirements.

Write today for catalog and an actual demonstration on *your* work at *your* plant by a Strippit Mobile Unit.

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ROD ENDS

There are heavy duty Heim Unibal Rod End Bearings with BIG capacity and durability for use on unusually heavy linkages. They operate the compressed air clutch; they control the swing mechanism and the steering brakes; they help eliminate slack in the reverse swing and travel clutches; and contribute to the dependability and low maintenance of such heavy duty equipment.

The shapes and sizes, methods of fabrication and types of attachment to adjacent units are as varied as the number of installations. Heim Unibal is easy to install, easy to inspect, and easy to maintain.

No other device can correct misalignment better than Unibal, the spherical bearing. The maximum angle of misalignment for each of three types of mountings most commonly in use, is shown in this drawing . . .

For rod end applications in linkage mechanisms, other limiting factors may prevail, but the ability of the Unibal Rod End bearing to correct misalignment varies only in degree.

A wide range of stock sizes is available.

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F Series	.1900 – .5000	.750 – 1.312	1.750 – 3.031	2,848 – 7,202 lbs.
M Series	.1900 – .2500	.750 – .938	1.935 – 2.969	1,695 – 3,723 lbs.
MF Series	.1250 – .7500	.469 – 1.750	1.046 – 3.750	1,201 – 11,326 lbs.
HM Series	.1250 – .7500	.469 – 1.750	1.172 – 3.750	452 – 11,326 lbs.
HFX Series	.2500 – .7500	.750 – 1.750	1.687 – 3.750	5,390 – 23,234 lbs.
HMX Series	.2500 – .7500	.750 – 1.750	1.937 – 3.750	5,390 – 23,234 lbs.

Components for Unibal Rod Ends are made of various suitable materials. Lubricators are supplied when specified. The Heim catalog gives complete specifications on all stock items; be sure to have one at your finger tips.

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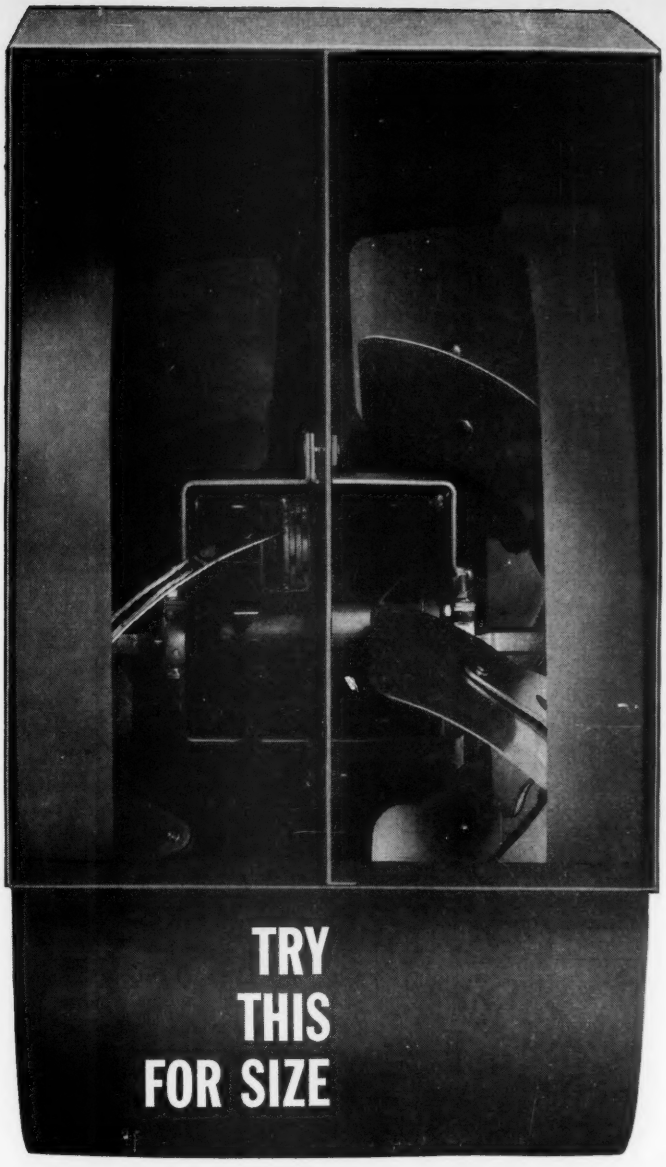

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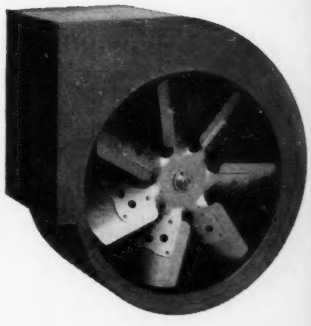

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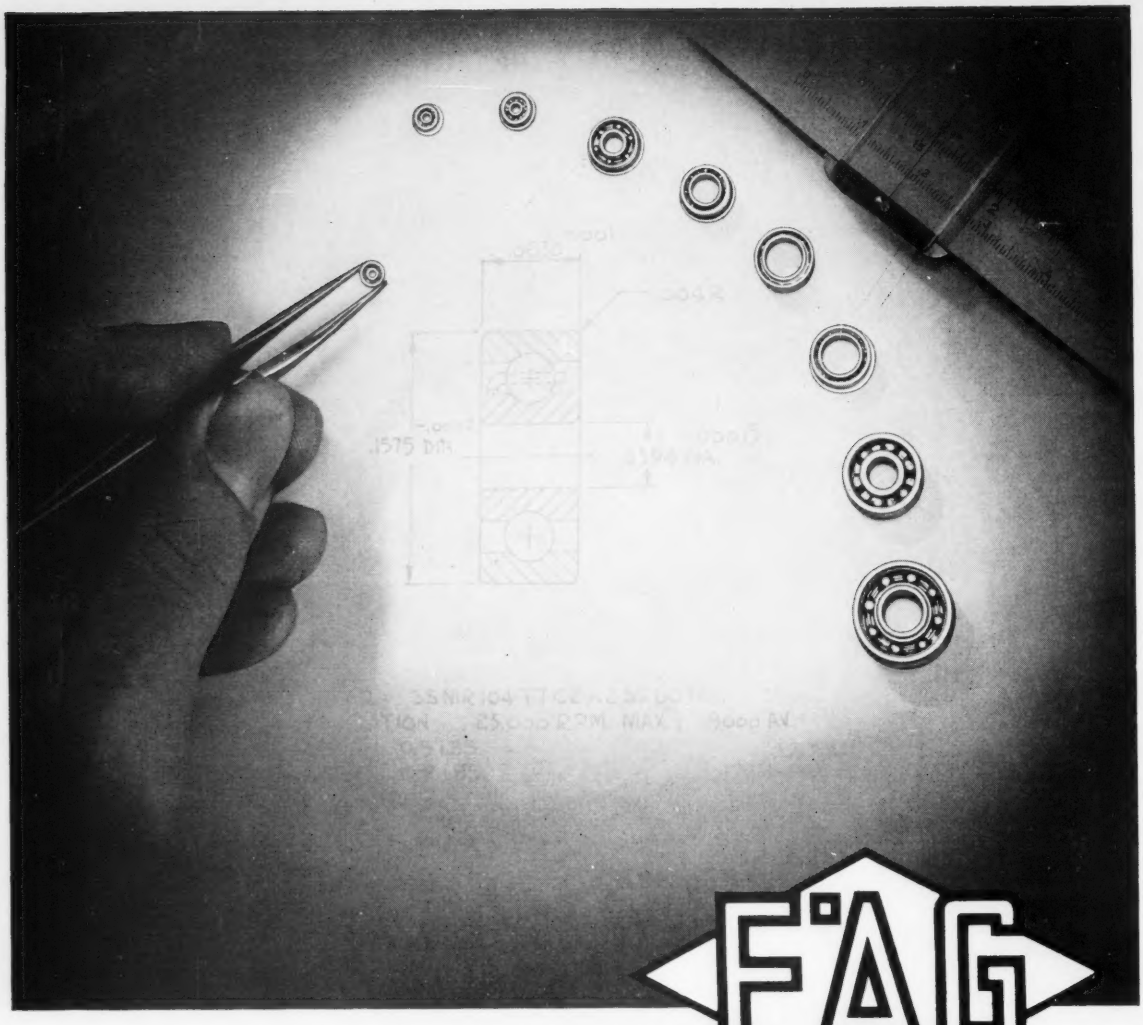

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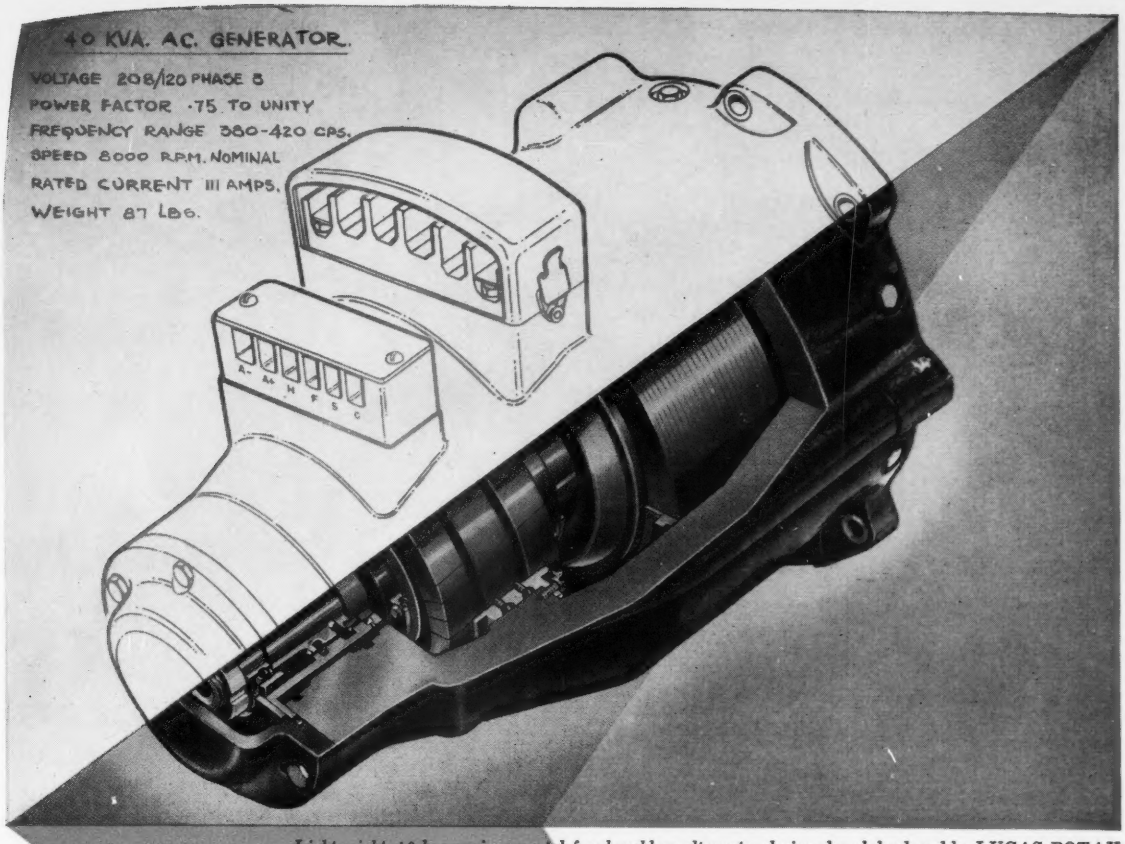
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Nickel helps give stainless steel its exceptional strength and its resistance to corrosion . . . makes it easy to fabricate. Specify nickel-containing stainless steel for interior and exterior applications in building or remodelling. We will be pleased to supply additional information on the use of stainless steel as an architectural material.

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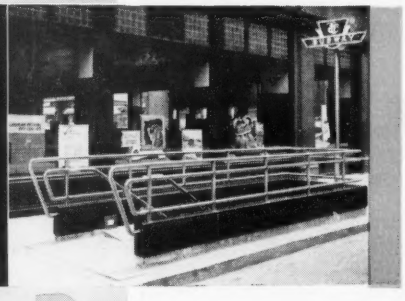
In the Toronto Subway, stair rails, entrance barriers, ticket booths and door frames made of nickel-containing stainless steel add bright beauty and insure lasting, low-cost service.



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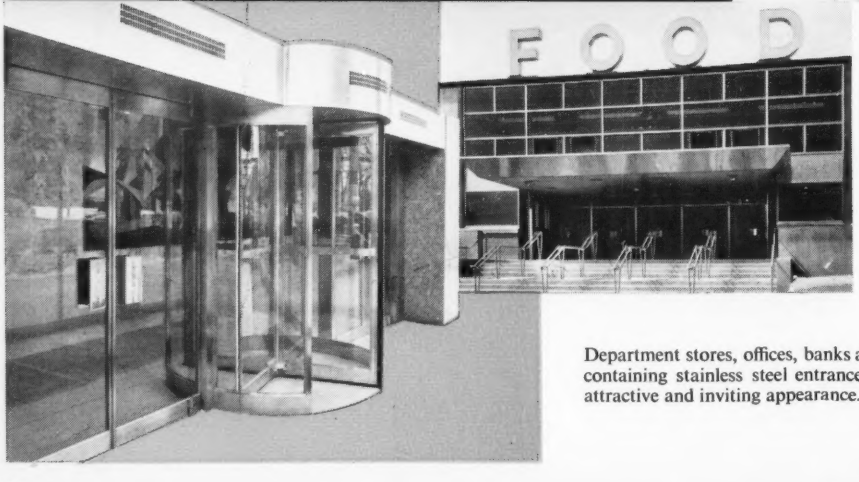

Stainless steel doors, railings and trim provide a handsome weather-resistant entrance to the Food Products Building at the C.N.E.

Department stores, offices, banks and small shops with nickel-containing stainless steel entrance-ways have a permanently attractive and inviting appearance.

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from TADANAC ZINC

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Backed by one of the world's largest Zinc producers, Tadanac Zinc is the preferred brand with alloyers and die casters who demand consistent high purity, assured supply and prompt delivery.

For information or assistance regarding Zinc die casting operations, contact our Technical Service Staff. Your inquiries will be given immediate attention.

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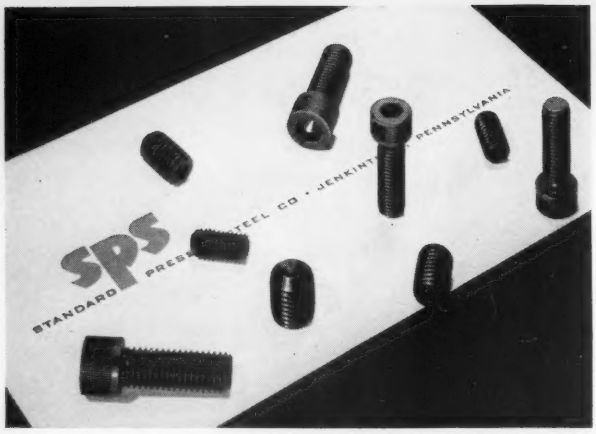
TADANAC ZINC SHAPES THE THINGS TO COME

57185-T



Standard microsize UNBRAKO socket cap and set screws, #0 through #3, are supplied by your authorized industrial distributor in heat-treated alloy or stainless steel. Available with Nylok* self-locking feature.

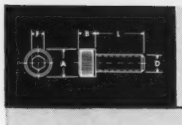
Microsize UNBRAKO Socket Screws Simplify Fastening of Small Assemblies

Microsize UNBRAKO socket cap and set screws save both time and money in the design and assembly of your small devices. Precision manufactured, available locally, they eliminate the cost and delay of designing or procuring special screws to fasten tiny components. Use them in computers, servomechanisms, instruments, miniaturized electrical and electronic equipment—countless small, intricate devices where reduction in weight and bulk is required without sacrificing strength or reliability.

These miniature socket screws have all the advantages of larger UNBRAKOs. Deep, accurate sockets for non-slip, high-torque wrenching. Radii in socket corners to eliminate sharp angles where cracks start. Fully formed threads for greater strength and precision fit. Controlled fillets under cap screw heads to prevent shearing. Careful heat treat for maximum tensile values without brittleness or decarburization. Because of these features, microsize UNBRAKO socket cap screws are as much as 80% stronger than ordinary miniature cap screws, and microsize UNBRAKO socket set screws can be torqued tighter than ordinary miniature set screws. This extra strength means greater reliability in the fastening of your small assemblies.

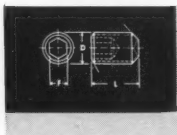
For more information, see your authorized distributor. He carries microsize UNBRAKOs in both alloy steel and stainless in sizes #0, #1, #2 and #3. Or write us for Bulletin 2055 and samples.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



HEAT-TREATED ALLOY STEEL
Microsize UNBRAKO Socket Cap Screws
Class 3A Threads

Diameter		Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0	A .096		80	1/8		2.0	.21
	B .060		80	3/16		2.0	.22
	D .060		80	1/4		2.0	.26
	F .050		80	3/8		2.0	.33
#1	A .118		72	1/8		3.5	.31
	B .073		72	3/16		3.5	.36
	D .073		72	1/4		3.5	.42
	F .050		72	3/8		3.5	.53
#2	A .140	56		3/16	6.0		.54
	B .086	56		1/4	6.0		.61
	D .086	56		3/8	6.0		.76
	F 1/16	56		1/2	6.0		.91
#3	A .161	48		3/16	8.5		.77
	B .099	48		1/4	8.5		.87
	D .099	48		3/8	8.5		1.07
	F 5/64	48		1/2	8.5		1.27



HEAT-TREATED ALLOY STEEL
Microsize UNBRAKO Socket Set Screws
Class 3A Threads—Plain Cup Point

Diameter		Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0			80	1/16		.5	.03
			80	3/32		.5	.04
	D .060		80	1/8		.5	.05
	F .028		80	5/32		.5	.06
			80	3/16		.5	.08
			80	1/4		.5	.11
#1			72	1/16		1.5	.04
			72	3/32		1.5	.06
	D .073		72	1/8		1.5	.08
	F .035		72	5/32		1.5	.11
			72	3/16		1.5	.13
			72	1/4		1.5	.19
#2		56		1/16	1.5		.05
		56		3/32	1.5		.07
	D .086	56		1/8	1.5		.107
	F .035	56		5/32	1.5		.15
		56		3/16	1.5		.19
		56		1/4	1.5		.273
#3		48		3/32	5.0		.10
		48		1/8	5.0		.135
	D .099	48		5/32	5.0		.18
	F .050	48		3/16	5.0		.235
		48		1/4	5.0		.32

HIGH RELIABILITY

SPS research is continually developing fasteners with higher and higher standards of predictable performance. By installing SPS high-reliability fasteners in your assemblies, you increase your overall product reliability.

For more information on the full meaning of reliability, write for a copy of the new SPS booklet "High Reliability."

UNBRAKO®

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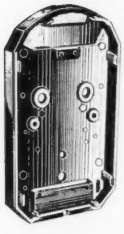
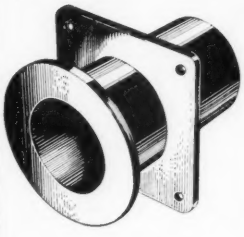
Today's Products

benefit from

"BAKELITE" Phenolic Plastic Properties

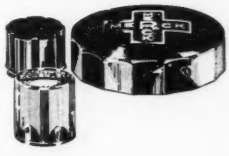


TELEPHONE BASE
—for moldability, machineability, strength

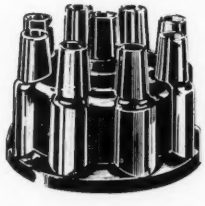


TRANSFORMER PART
—for dielectric properties and dimensional stability

IRON HANDLE AND DIALS
—for heat resistance, appearance

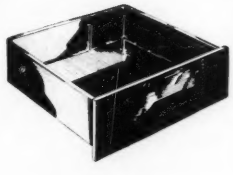


CONTAINER CAPS
—for strength and appearance

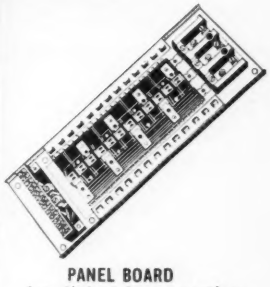


DISTRIBUTOR CAP
—for moldability and dielectric properties

TELEPHONE RECEIVER
—for strength, moldability, appearance



FURNITURE DRAWER
—for moldability and strength



PANEL BOARD
—for dielectric properties, dimensional stability

Check these properties for your component parts:

- ★ **MOLDABILITY**
- ★ **MACHINEABILITY**
- ★ **DIMENSIONAL STABILITY**
- ★ **HEAT RESISTANCE**
- ★ **APPEARANCE**

All these products have one thing in common—the "Bakelite" phenolics plastic from which they are made.

In each case the plastic has been chosen for a particular purpose—to provide electrical insulation, close tolerances, resist heat, water or chemicals, machineability, and adaptable to intricate shapes. Besides these properties, the component part must retain its serviceable good looks indefinitely.

We suggest you investigate—could your product look better, perform better, and last longer made of quality "Bakelite" phenolic materials?

Write for a list of phenolic plastic molders in Canada.

"BAKELITE" PHENOLICS

UNION CARBIDE

BAKELITE COMPANY Division of Union Carbide Canada Limited

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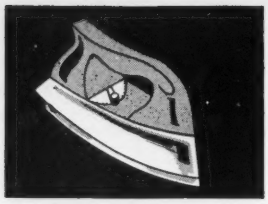
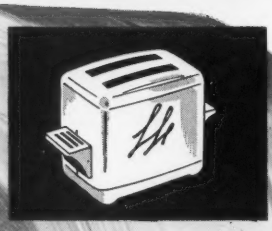
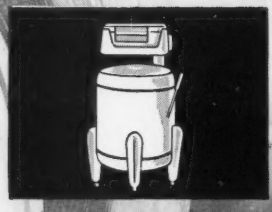
product to demand

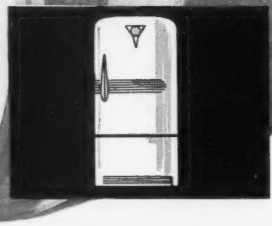
HIGH QUALITY HOT OR COLD ROLLED SHEETS AND STRIP

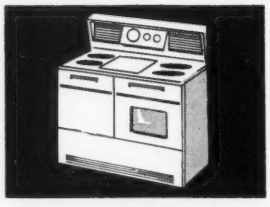
made and processed to proper
specifications to meet your
exact manufacturing requirements

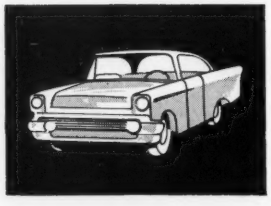












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- Hot Rolled Sheets and Strip—mill or slit edge —black or pickled and oiled
- Cold Rolled Sheets and Strip—mill or slit edge —dull or bright finish—Nos. 1,2,3,4 and 5 temper
- Cold Rolled Electrical steel in Field, Armature, Electrical and Motor grades

ALGOMA STEEL
CORPORATION, LIMITED
Sault Ste. Marie, Ontario

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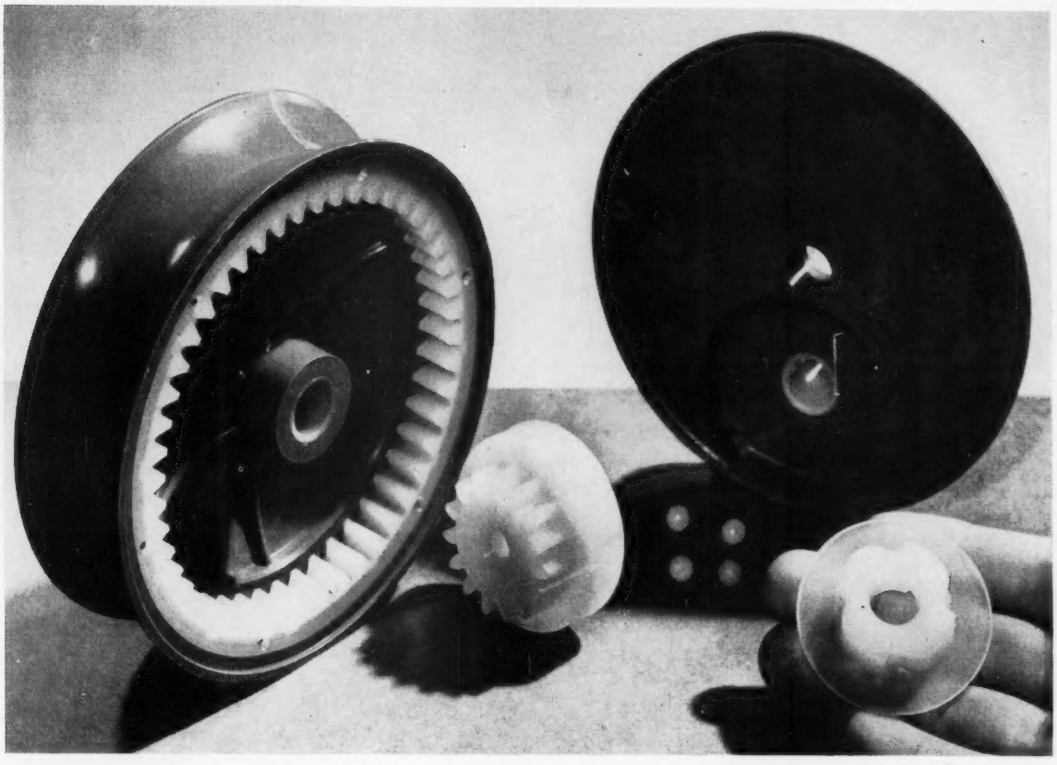
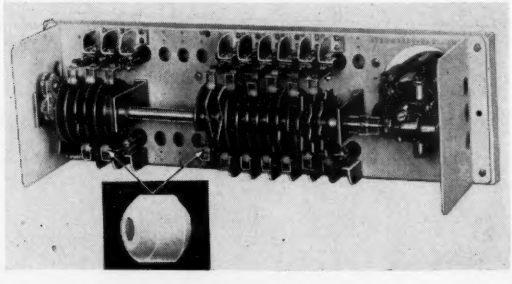


Nylon's versatility at work and play

Cam followers

The Stromberg-Carlson Company developed a motor-driven timer and circuit interrupter capable of making (or breaking) circuit contact in a sequential manner, with an accuracy measured in milli-seconds. The equipment was developed for telephone exchanges, where heavy performance is required without breakdown or maintenance.

Components contributing to this performance are the small Polypenco 101 nylon cam followers which turn on case-hardened steel cams. The basic properties in nylon that lend themselves to this application include: resistance to wear, low friction without lubrication, quiet operation and low cost.



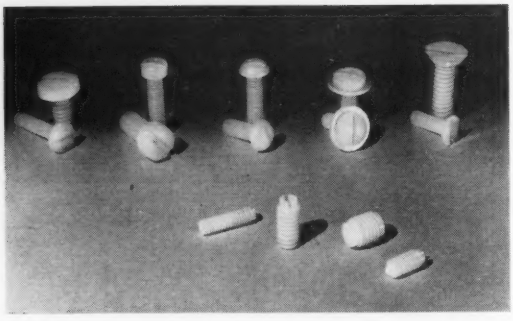
The circuit interrupters have performed more than a billion mechanical operations without failure. This represents 20 years at the rate of 100 impulses a minute.

Nylon is playing such a prominent part in design these days that we think this collection of applications will be of interest and help to the design engineer.

A wide selection is shown, from gearing to a spinning reel and even football cleats.

The information was collected from various sources, but we should like to acknowledge the help given by the Barrett Division of Allied Chemical & Dye Corporation, for details of Plaskon parts; Du Pont Canada Ltd., for information on Zytel parts; Chicago Molded Products Corp. and Polypenco, Inc.

Molded nylon screws



Now available from Gries Reproducer Corporation: molded nylon machine screws, and headless set screws, stock sizes 4-40, 6-32, 10-32 and ¼-20. Lengths range from ¼ to 1 in., in standard increments of ⅛ in., with special intermediate lengths also available.

The machine screws have standard binding, round, fillister and flat heads, in Phillips or slotted types. All but the flat head are available with an integral washer molded beneath the head of the screw. These one-piece washer-head machine screws provide an effective seal under the head, do away with a separate washer, and are ideal for oversize or offset holes and adjustment slots. Headless set screws are available, too, with a variety of points: plain, cone, oval, flat, half-dog and full-dog.

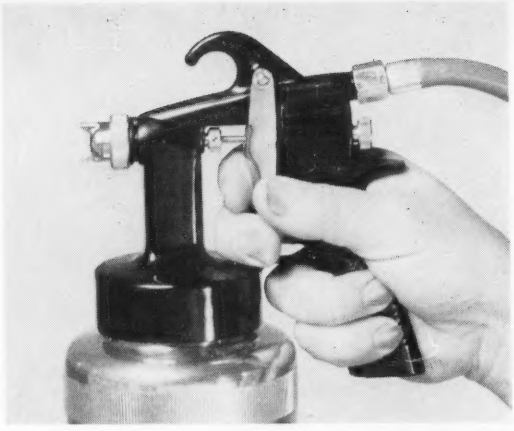
These fasteners have many design advantages: excellent electrical insulation, corrosion resistance, stability over a wide range of temperature, high strength-to-weight ratio (higher than steel), non-magnetism, non-toxicity, low thermal conductivity (which makes the material "warm to the touch") and low coefficient of friction. These properties are taken advantage of in the electrical, electronic, chemical, automotive, aircraft, food processing and metalworking industries. The nylon screws are molded one at a time (by the unique single-cavity method) to extremely close dimensional tolerances. The screws are supplied in natural (off-white) color, but other colors can be produced to order.

Football cleats

Three different styles of steel-tipped nylon football cleat are being offered by the Feather Tip Football Cleat Division of M & S Manufacturing Co.

These lightweight cleats are composed of a solid Plaskon nylon body with a one-piece steel thread and tip molded in. The use of nylon and steel (it is claimed) eliminates the formation of burrs and sharp edges and thus prevents injuries and torn equipment.

Spray gun

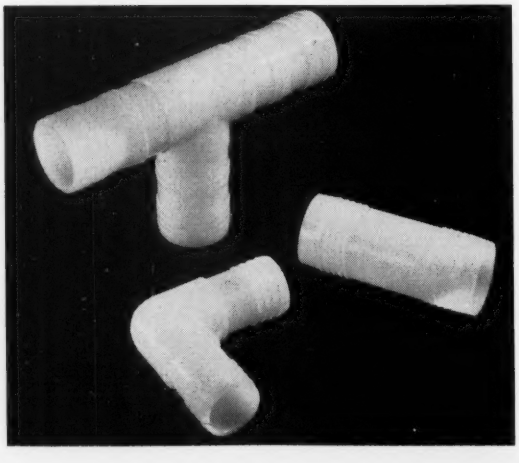


The main feature of a paint spray gun made by Thomas Industries, Inc., is the one-piece, black nylon gun body that replaces a three-piece, die-cast aluminum assembly.

In switching from aluminum to nylon (in this case Du Pont's Zytel 101), a weight reduction of 66% was achieved, to allow easier handling and more effective control of the spray pattern. At the same time, the nylon-to-metal screw threadings between gun body and paint container, gun body and lock ring, and gun body and fluid-tip, offer a better air seal than the previously employed metal-to-metal seal.

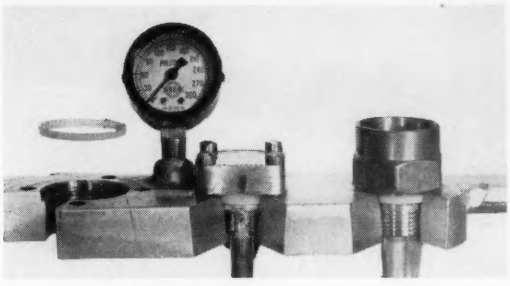
Since nylon is not affected by common solvents, alkalies and most organic acids, it is the ideal material for this application. The gun handle is much easier to clean and maintain, for paint does not stick to nylon as it does to metal. Due to nylon's high-hardness and its low coefficient of friction, the gun has excellent abrasive resistant qualities, giving it a smooth, sparkling black finish that remains new-looking for years. Nylon also provides strength and structural efficiency. In molding the entire body (made by Chicago Molded Products Corp. in one piece from nylon) six machining operations previously needed were eliminated, along with the polishing, buffing and plating operations necessary to give the aluminum gun a black finish.

Insert-type fittings



These insert-type nylon fittings, characterized by toughness, lightness and low cost, bring new resistance to corrosion and mechanical abuse in flexible pipe installations. Manufactured by Plastiline, Inc., the fittings are incorporated in jet well installations, industrial piping and air conditioning systems.

Float ring



A float ring molded of nylon for use with a quick-disconnect fitting for domestic propane systems, was the successful answer to a problem encountered by Black, Sivalls & Bryson, Inc., manufacturers of oil field equipment, steel products and control valves.

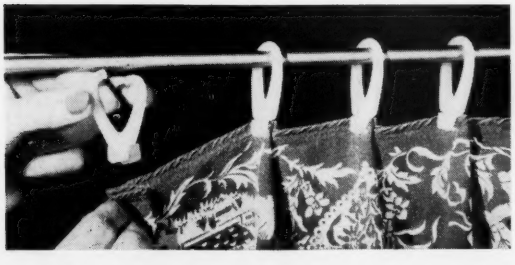
Fittings for domestic propane systems have traditionally been held and sealed into tanks by taper pipe threads. The non-uniformity of the threads (and the difficulty of assembly) stimulated the search for a better way to secure the fittings to the tanks and seal the high pressure liquefied petroleum gas inside the tank.

The search led the company to consider another type of connection-seal device: a float ring seal used for some time by the firm in its high pressure, quick-disconnect fittings for the petroleum industry. The device consists of a wedge-shaped ring which contacts a concave truncated cone on the male fitting, and a convex truncated cone on the female fitting, making the seal by close juxtaposition. Because the ring is wedge-shaped, the pressure on its broad underside causes it to float up into the narrowing opening, making the seal progressively tighter as the pressure increases, an excellent method for pressure sealing.

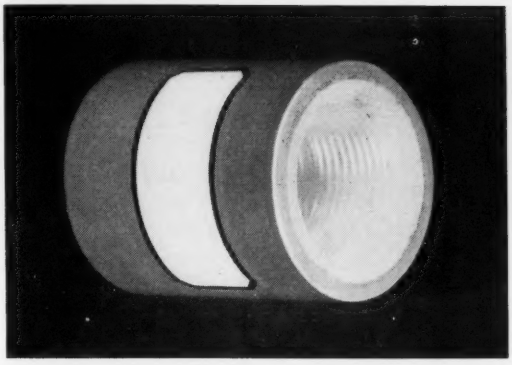
Due to the intense unit pressure applied to the ring, and the resultant sliding action, every experimental metallic material soon work-hardened and became harder than the brass cone on the fittings. It thus scored and scratched the cone.

Plaskon nylon 8200 molding compound was chosen, because of its outstanding ability to withstand high compressive forces without work hardening; its excellent resistance to cold-flow; its insolubility in hydrocarbons; its clear unpigmented color and its uniformity of quality in the finished product.

Clothes pegs



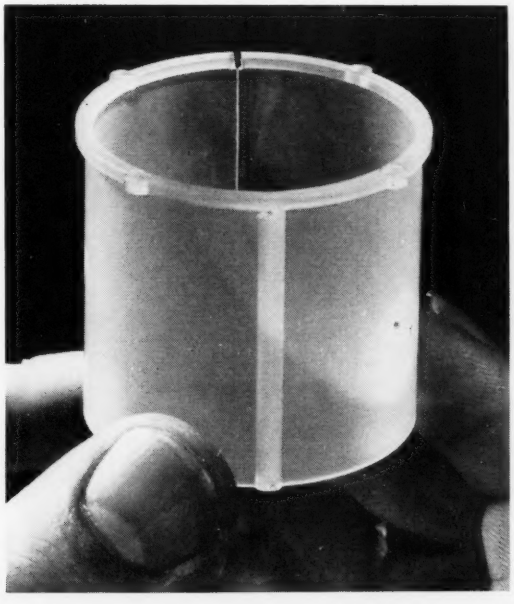
Insulating couplings



Insulating couplings, consisting of a threaded sleeve molded of Plaskon nylon within a steel sleeve, are designed for large-scale use by gas utility companies. They serve as dielectric connections between sections of piping on gas distribution systems.

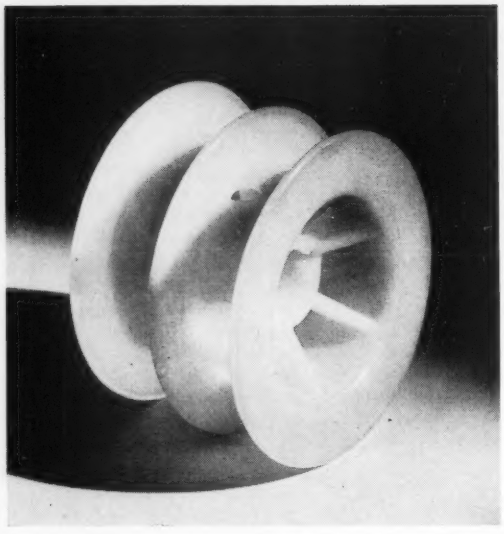
Once installed, the permanent couplings ensure electrical insulation and eliminate corrosion and withstand bending, side-thrust and shock. A special locking device prevents these Pesco couplings from turning or slipping within their steel sleeves. They withstand pressures up to 1,100 psi and are unaffected by temperatures up to 300 F. They are available in all sizes from ¾ to 2 in.

Washing-machine bearing



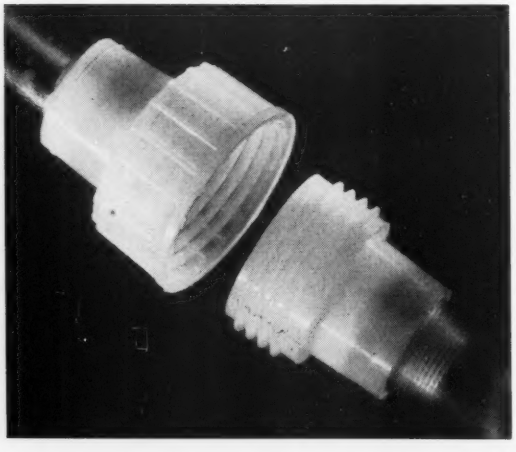
A bearing, for use in a washing-machine wringer, is silent in operation and does not require lubrication when made of Zytel nylon resin. The part, molded in one piece with no additional machining, is economical to manufacture too.

Steering wheel cable drum



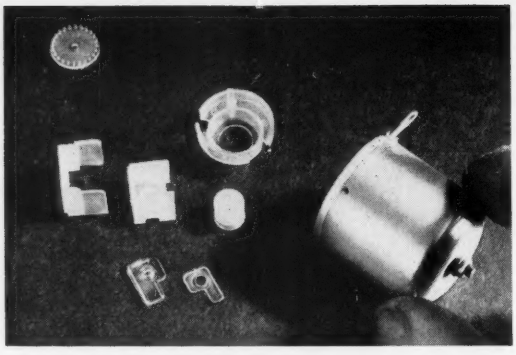
Moldings of Zytel resin often do as good a job as comparable metal parts, and may be simpler to produce. This steering wheel cable drum for an outboard motor is completed in one molding operation. The fabricated aluminum part it replaced required half a dozen operations to assemble. (Molded by Toronto Plastics Ltd. for Brydon Brass Manufacturing Co. Ltd.)

Hose coupling



An injection-molded hose coupling for use with standard ½-in. rubber or plastic hose is made of Zytel resin. The couplings are designed for high strength, ease of attaching and removing, low pressure loss and low cost. Nylon was chosen for this application because of its high corrosion resistance and over-all durability.

Precision motors



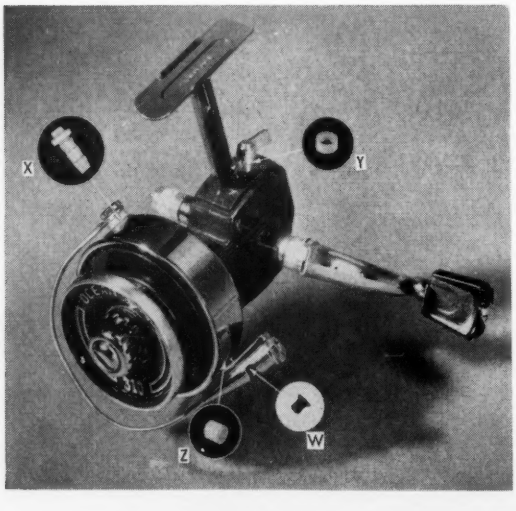
A series of circular miniature dc motors designed to resist shock, heat and cold has been developed for the radio, electronic, phonograph instrument and automotive industries.

Known as Series 500, they are a product of Rowe Industries, Inc. Superior insulation and a smooth-running life result from the use of nylon-molded commutator hubs, lead insulators, motor brush supports and governor mounting base, which also resist vibratory fatigue and are self-lubricating. The nylon possesses good electrical insulating characteristics and lends itself to the relatively cheap molding of small parts of uniformly high quality.

Spinning reel

Four small nylon parts (machined from Polypenco nylon rod) have been engineered into the new 300 series of spinning reels by the Montague-Ocean City Rod & Reel Company. Nylon has proved ideal for the wear parts in the reel, increasing service life and providing smooth, quiet operation.

Parts X, Y and Z are fabricated from white nylon 101 stock, whilst the line roller (Part W) in the thread pick-up (or bail) is machined from Nylatron G, a graphite-filled nylon composition with high wear resistance and a very low coefficient of friction.



Diesel pile driver: here's how it works

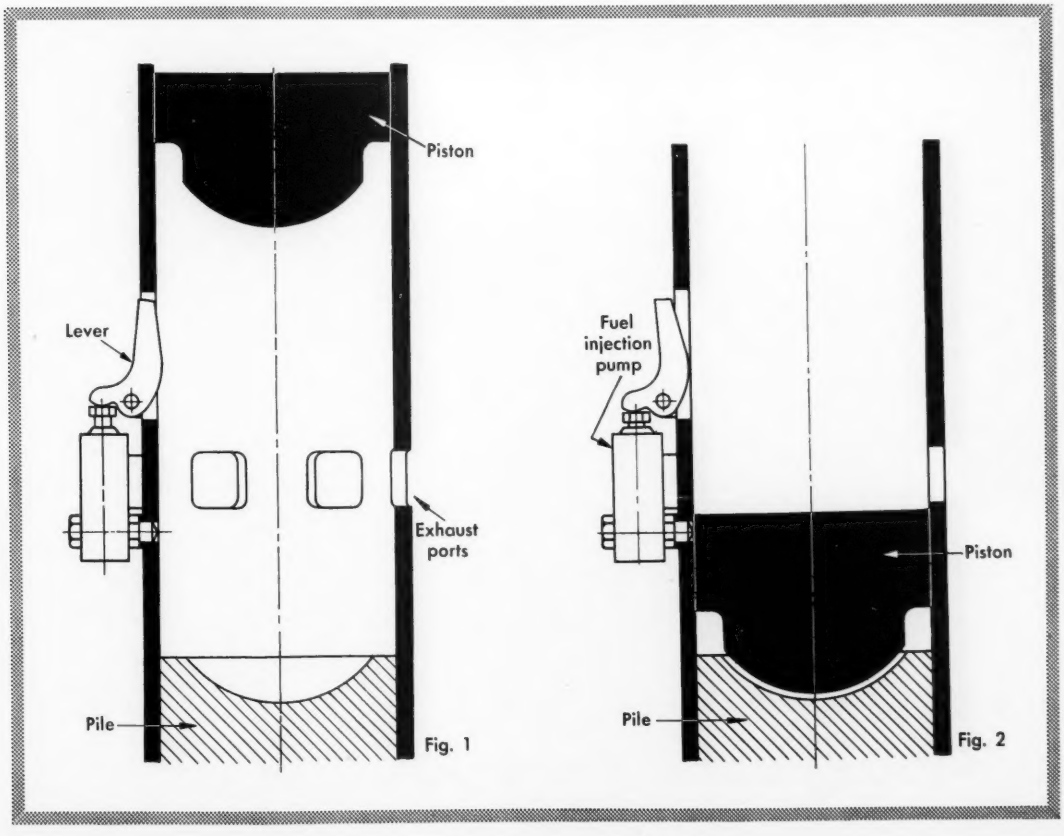
Inside information on the workings of a machine familiar to us all

You may have seen a diesel pile-driver and wondered how it works. It is an internal-combustion engine reduced to the ultimate in simplicity. Working on the free-piston principle, it has a single piston which moves vertically, so that it is returned on the compression stroke by its own weight. Fig 1 shows the piston at the end of its upward stroke. From this position, it falls freely, first tripping the lever of the fuel pump, to inject a charge of fuel under low pressure into the cylinder. Continuing on its downward stroke, the piston next covers the exhaust ports and compresses the air charge. In Fig 2, the piston has reached the end of its downward stroke, the fuel charge has been ignited by the heat of compression and the piston is being driven upward.

To start the pile driver, it is only necessary to hoist the piston to the end of its up stroke and then allow it to fall freely. The piston has a stroke of about 4½ ft and works at a rate of about 60 cycles per minute. The cylinder rests on the pile to be driven which is, of course, thrust downward by the pressure of combustion.

Three sizes of diesel pile driver are available. In the medium size, the piston weighs about 2½ tons and the maximum load on the pile is about 47 tons.

(Prepared by P. E. Biggar from information supplied by Special Construction Machines, Ltd.) ★



1. Graphite finds an application in these divergent cone sections for rockets. There are no suitable metals.

Missile programs boost graphite's use

Properties cited here will account for its extensive use in recent years

In the ever-changing picture presented by developments in rockets and missiles, structural materials are being drastically re-evaluated. One of the most important materials for super-high temperature components is graphite. Its advantages, uses and potential are given here.

Leo Simbeck, Francis Weiner, I. L. Harvey, SPEER CARBON CO.

Today's greatly accelerated rocket and missile programs demand materials that will survive much higher temperatures, pressures, velocities and load factors than were deemed possible ten years ago.

Graphite is a material of vital importance to the growth of rocket development. In some of the most critical areas of present-day rocket and missile design (where combustion and temperature requirements are most severe), it has been the best possible (in many cases the only possible) material that could be used.

The experience of Speer Carbon Company in this field is given below, within the limitations of security restrictions. It also suggests certain aspects in the design and fabrication of graphite, where knowledge of the limitations (as well as the advantages) may prove helpful to design engineers.

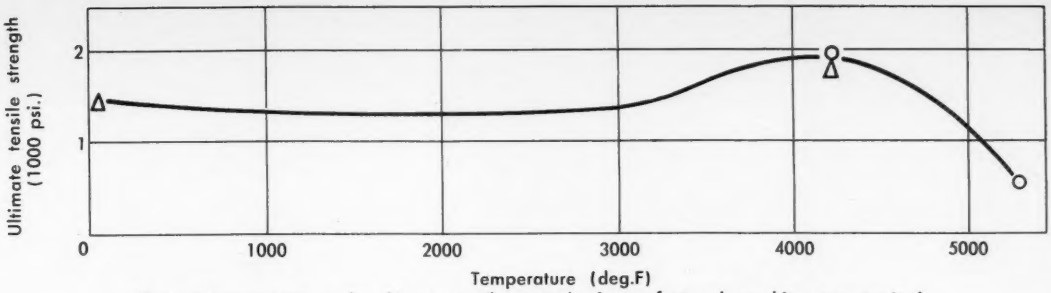
As a general statement, graphite is used for rocket components where metal (or other materials) cannot be used. Most notably this applies to critical areas in which excessive heat or extreme abuse from fuel exhaust or similar factors are involved.

More specifically, graphite is the preferred material for solid-fuel rocket nozzle inserts (Fig. 2), which direct and restrict the flow of fuel gases. It is also used for divergent cone sections (Fig 1), to a limited extent for fuel liners, and for vanes in the discharge portion of the rocket (Fig 3).

Graphite is also used as a heat exchanger material, because of its excellent heat conductivity and resulting rapid dissipation of heat. Other applications include bearings, brushes and seals in other sections of the rocket.

The properties of graphite (set out below) account for its extensive use in what is undoubtedly one of today's most severe structural material requirements.

(1) **Thermal shock resistance.** Not only has graphite excellent thermal shock resistant properties, but its



Effect of temperature on the ultimate tensile strength of manufactured graphite at a nominal strain rate of 0.00005 in./in./sec. Specimen heated to test temperature within 20 sec.

strength increases with temperature. This continues up to approximately 4,700 F, as indicated in Fig 4.

(2) **Chemical inertness.** Manufactured graphite is a 99% chemically pure material, inert to chemical reaction with almost any other substance. It therefore has little or no chemical effect on dissimilar materials with which it comes in contact.

(3) **Machineability.** Graphite may be described as a "machineable ceramic." It can be machined to practically any prescribed shape, to extremely close tolerances, with a minimum of special equipment. The simpler the design, of course, the lower will be the fabrication costs.

(4) **Coatings and impregnants.** It can be given additional properties (or desirable properties can be augmented) by means of coatings, impregnations and plating processes. Theoretically, graphite can be impregnated with any material that can be liquefied.

Graphite is commercially impregnated with a variety of resins, waxes and oils, as well as such metals as copper and silver. It can be coated with aluminum oxide, zirconium oxide, silicon carbide and other protective coatings, and can be plated with any metal that can be deposited by the electroplating process.

In rocket applications, impregnations and coatings have been used to prolong the life of the graphite component. In some instances erosion (caused by high-velocity gases) has been reduced as much as 40% thereby.

(5) **Weight.** Last but not least; the material is relatively light, with a specific gravity of 1.5 to 1.8.

Design pointers

As regards design, certain features should be avoided whenever possible, because of the nature of the material. For example, knife-edges are sometimes specified, even when not necessary. A knife-edge on a graphite part always presents a chipping problem during manufacture, shipping and final assembly. Whenever possible, a flat or chamfered edge is preferable.

Similarly, outside square corners are subject to chipping and notching. Design modifications (such as chamfers and fillets) should therefore be made on corners. In some instances, a small collar or step can be machined at the entrance end of a nozzle insert, and subsequently removed during final assembly. To summarize, most design requirements can be met by the graphite manufacturer.

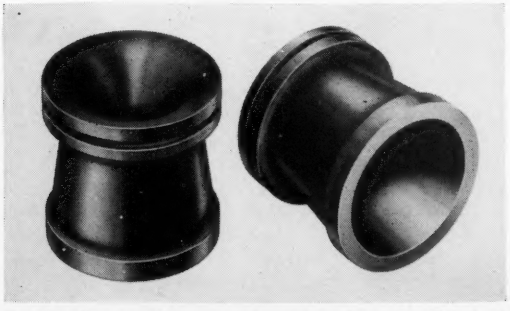
Graphite cannot be machined to the same degree of surface finish, nor can its finish be measured as metal finishes are.

It is a porous material (up to 30% porosity), and the quality of the surface finish depends on the particle size, machining techniques and so on. Porosity is one of graphite's main advantages, because it increases the resistance to thermal shock.

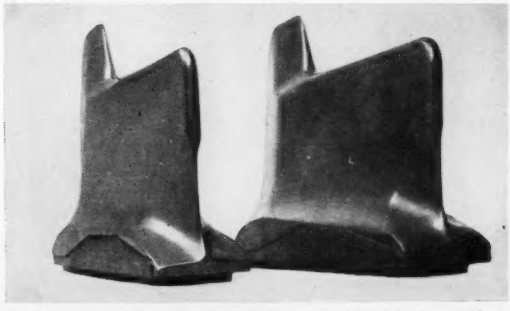
There are several methods of joining or fitting the finished graphite part to another component in the rocket. The graphite nozzle insert is joined with other parts by interference (or force fit) in OD sizes under 8 in. Such parts must be manufactured within a tolerance of 0.003 in. of the receiving member.

Larger inserts are joined to the nozzle body by shrink fit, with the nozzle body expanded by heat and the graphite part then inserted. Graphite can also be joined to other parts by threading and fastening with metal bolts. A coarse-thread series is preferred in this method.

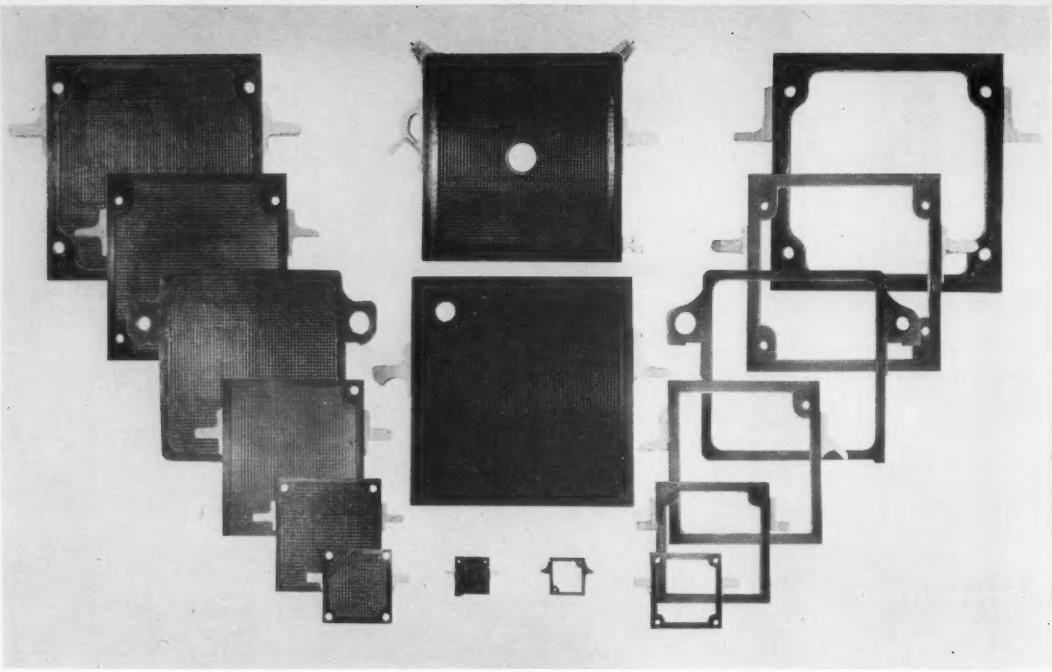
Cements have been used with graphite to some extent, but they are not effective at elevated temperatures. When used in rockets and missiles, they serve merely to hold the part in place until used. No entirely satisfactory cement has so far been developed for graphite. ★



2. Nozzles restrict gases from burning of solid fuel.



3. Vanes used in the discharge portion of the rocket.



Glass and plastic make a filter plate

They are lightweight, chemical resistant and less expensive as well

The fibre glass reinforced polyester filter plates, frames and recessed plates designed and manufactured in Canada by William R. Perrin Ltd., are the answer to the long-standing need for a filter plate and frame with the characteristics of strength and reduced cost.

A large number are in full production use. Applications include uranium, copper, zinc and gold-refining operations, various soap plant filtrations, fatty acids, pigments and dyes, vinegar, brine and pectin solutions, and various types of pharmaceutical solutions.

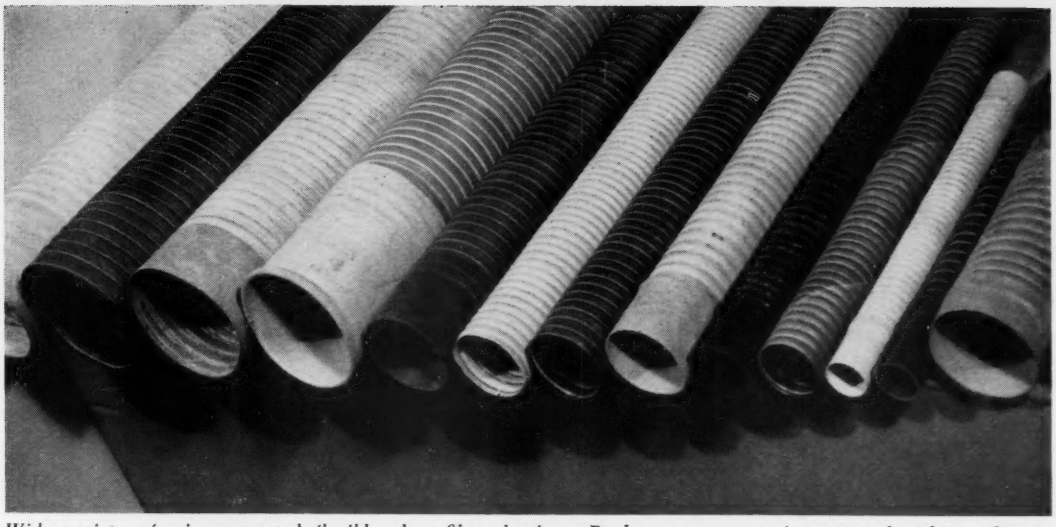
Molded from Cyanamid's chemical-resistant Laminac resin, reinforced with fibre glass, the plates and frames show excellent resistance to a wide range of corrosive materials, and (depending upon the type of material being handled) will withstand temperatures up to 240 F. Where liming-up conditions are a problem, these polyester plates and frames are ideal.

The smooth, hard surface greatly facilitates cleaning, and reduces the possibility of product contamination between different batches, particularly as compared with wooden plates and frames. There is no coating to chip (or erode) thus eliminating the problem of corrosion and deterioration which frequently occur when a protective coating is used on a metal plate. The joint surfaces of the plates and frames are held to very close tolerances by grinding, to ensure a perfect seal.

Because of their great strength, a narrower margin can be used with the polyester than with wooden plates and frames, and 25 to 30% greater filtering area and cake capacity are thus gained. In addition, the plate is from ¾ in. to 1 in. thinner than the usual wooden plate, and so a greater number of filter chambers can be used in a existing press. A combination of these factors can sometimes mean an increase of about 65% in filtering area and cake capacity when replacing wood with polyester in an existing filter press.

The polyester plates weigh less than ¼ that of their equivalent in other chemically-resistant materials, such as rubber-coated or plastic-coated cast iron, nickel-iron, bronze or stainless steel. A 36 in. polyester plate weighs 57 lb, as against 270 lb in metal. With the usual 36 in. filter press, containing anywhere from 25 to 50 pairs of plates and frames, it is clear how this reduces shipping charges. Of greater importance, the handling of individual plates and frames by press operators for insertion, cleaning and dressing is faster and less tiring.

The plates are cheaper than other chemically-resistant materials such as rubber-coated steel. The initial cost of polyester is higher than wood, but because it has a longer life than wood, the net cost is lower. ★



Wide variety of wire-supported flexible glass fibre ducting. Dark are neoprene impregnated—white, silicone.

These hoses use silicone and neoprene

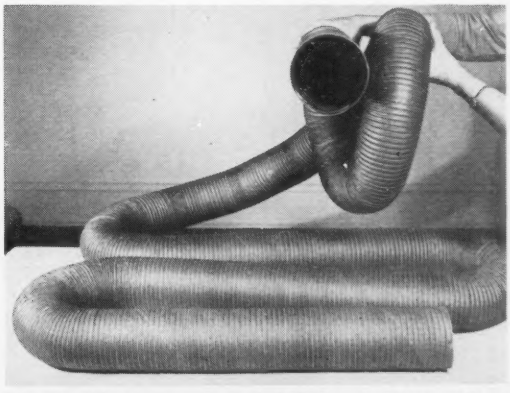
Some of this special shape ducting, which is over 3 ft. long, is used in airliners and military aircraft.

A lightweight product, the hoses handle the toughest assignments

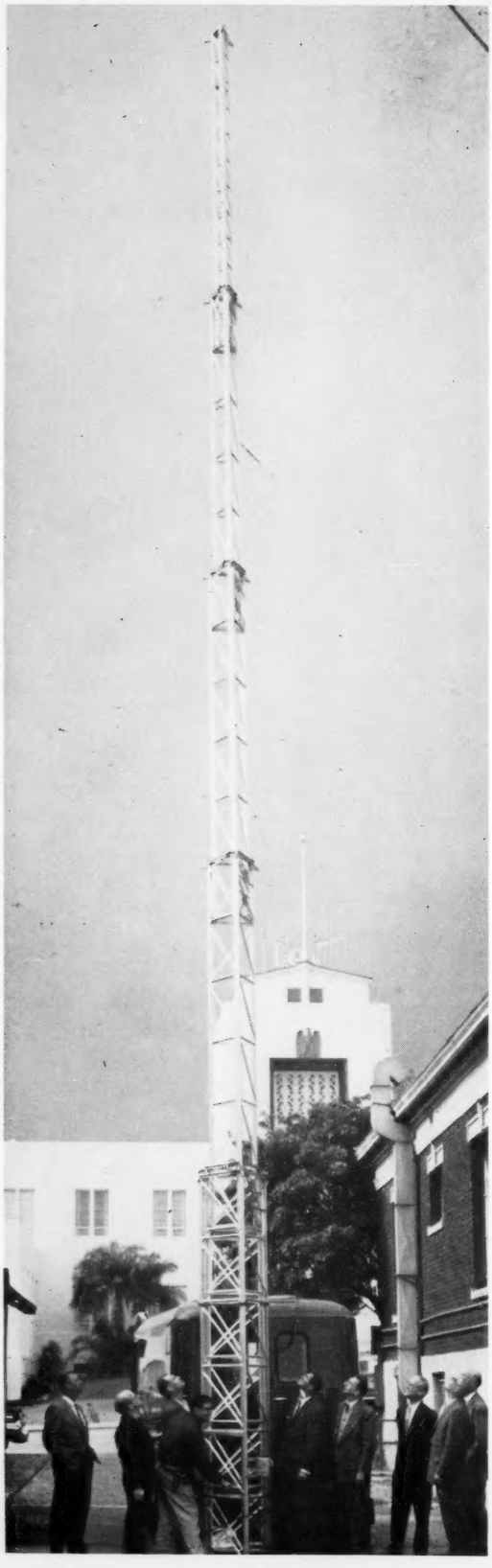
Silicone ducting for jet engines, missiles and pneumatic systems is being pioneered by Quaker Rubber Division's newest acquisition, Aero-Duct Works.

They also manufacture neoprene and silicone impregnated fabric products (in the form of rigid or convoluted ducts, sleeves, couplings and special shape ducts) and rigid fibre glass reinforced plastic ducts. Precision finished metal flanges are attached and built into the fuel system hose of many types of aircraft. ★

Fuel system hoses for U. S. fighter aircraft. Magnesium flanges have been bonded with the synthetic rubber.



Almost able to turn through 180 deg. in its own diameter, picture shows the ducting's good flexibility.



A manually operated tower van-mounted by the City of Burbank, California for fast mobile communications.

Tall towers can be

No need for climbing. These towers

John W. Dennis ASSISTANT EDITOR

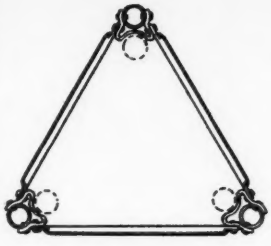
One of the hazards that go hand in hand with the erection of towers (such as those shown here) exists because of the need to ascend the tower as its sections go up. A tower that could be erected without the need to leave the ground, and would still have the advantages of collapsability, should find a ready market among people wanting such towers for radio, TV and survey work.

To tap this market, the **Alpar Mfg. Corp.** in California has designed a range of installations that meet these special requirements.

Their answer, in a nutshell, was to design a tower that could be cranked up from the ground. The outer sections move up first and this allows one man to erect a tall tower, guying it progressively, without any assistance.

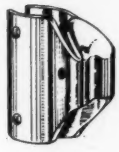
Uprights and cross members of extruded aluminum give the structure the necessary strength and rigidity at about one fourth of the weight of steel. These extrusions double as the tracks for nylon rollers on which the movement runs. The towers are available with fully extended heights of up to 200 ft and with the side width of their equilateral triangle cross section varying from 8 in. to 48 in. The telescoping sections are available in units of from 6 ft to 20 ft. and come in 2 ft increments.

Alpar has realized that the cranking up of a tall tower, safe as it is, could be a long drawn out business. To overcome this they have wisely made motor-driven models available. The hand-cranked models are driven by a self-locking winch and the powered models, with

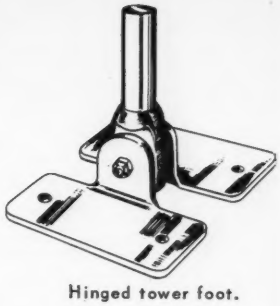


Typical cross-section.

Component close-up



Combination junction and slide.



Hinged tower foot.

cranked from below

go up without risking broken bones

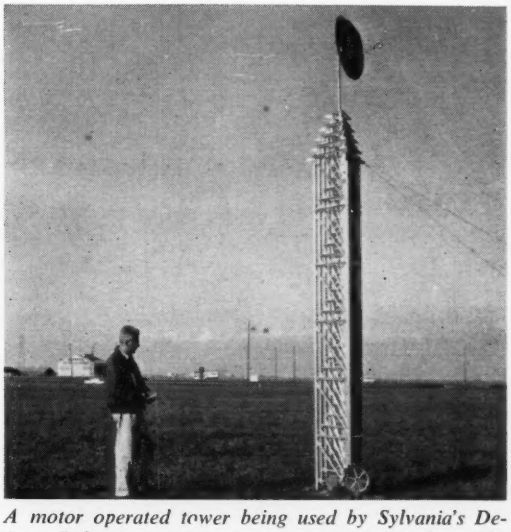
or without a remote control unit, are driven by an electric motor, cable drum and worm-gear assembly.

The towers retract to single-section lengths and can be moved from site to site while still guyed, if necessary. Short basic sections (of say, 6 ft to 12 ft) can easily be carried on a luggage carrier atop a station wagon, sedan or panel truck.

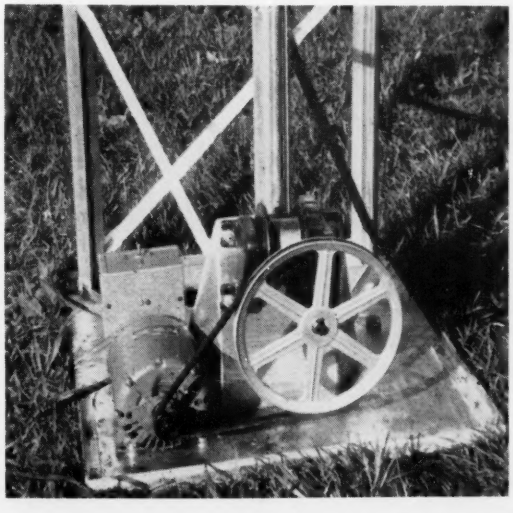
A safety feature on which Alpar has a patent pending is their Plunger Lock which locks each section as it reaches the proper level and also locks the tower sections together when telescoped for easy transportation. If necessary, one or more of the inner sections can be extended first, allowing several antennas to be attached at different heights. For survey work, when the full tower height isn't wanted, selection of the number of sections needed to get the desired height is possible by pulling the proper release cord, leaving the balance of the sections nested.

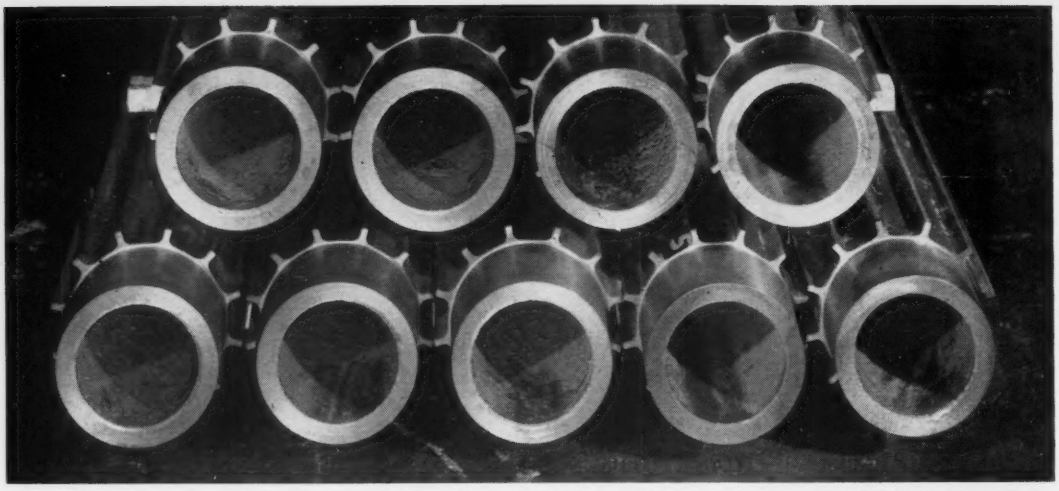
Horizontal and diagonal tubular members are of 63ST-832 alloy with ½-in. OD and 0.049-in. wall. Vertical tubing is of 63ST-831 alloy with ¾-in. OD and 0.058-in. wall. All junctions are secured by cadmium plated steel bolts and stop nuts. The 920 cable and pulley arrangements will hold the tower indefinitely at full height or any intermediate heights. Actuating spring and plunger are of stainless steel and the company claims that its plunger-lock assembly will withstand a load of over 1,800 lb. The rig is designed to handle gale winds in excess of 100 mph with top antenna loads of 100 lb.

Hinged anchor feet allow a nested unit to be raised to the vertical with little effort. Weight of these towers runs at approximately 1 lb per ft.



A motor operated tower being used by Sylvania's Defense Laboratory for antenna propagation studies. The remote control feature allows the technicians to vary the height as required. The extended height is 52 ft.





Centrifugally cast star roll bodies. These are of GC meehanite and are used in a coated fabric drying oven.

What has centrifugal casting to offer?

Thin, smooth, uniform walls and a denser, more homogeneous structure

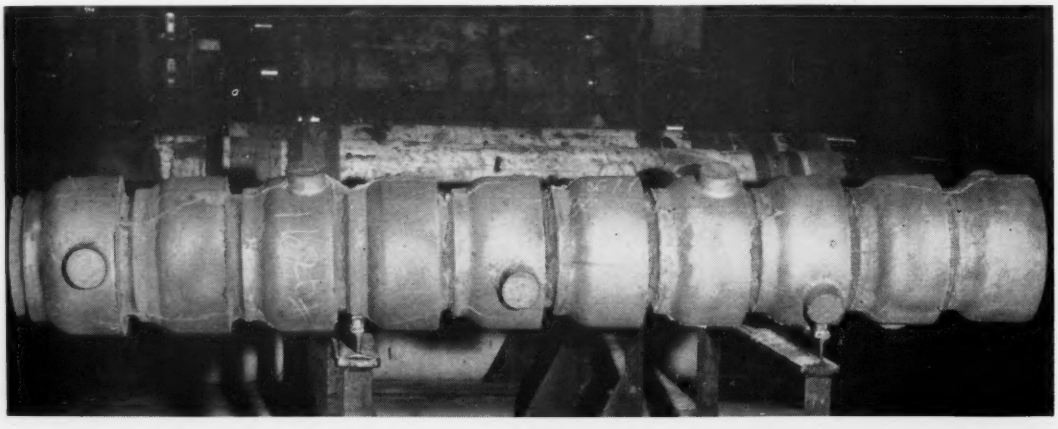
In the centrifugal casting method, molten metal is poured into a mold which is continuously rotating. The metal flies outward under the action of centrifugal force and forms a thin, hollow casting on the wall of the mold. Rotation is stopped after the metal has cooled to just below its solidification point. The casting is then removed from the mold. Sand molds, made by ramming sand inside a cylindrical flask, and metal molds covered with a thin refractory wash, are used.

Fig Y shows a typical arrangement of a sand mold. In addition to plain tubular shapes, symmetrical shapes (such as cylindrical parts carrying flanges, bosses, lugs or other projections on the outer surface) lend themselves to efficient production by the centrifugal process.

Advantages of centrifugal casting

1. On shapes where the inside is cylindrical, it is generally possible to have smaller wall thicknesses, and hence cheaper castings.
2. Can be sure of uniformity of wall thickness and dimensions, as compared with a static cast.
3. Can be sure of a much more dense and homogeneous structure.
4. Metal utilization (good-to-melt ratio) is far greater than with a static cast. This is because there is usually no sprue, runner or over-metal.
5. Internal surfaces are generally smoother than a cored casting.

A stick of ten centrifugally cast contoured castings. Closeup of one piece after parting is shown on page 59.



Shipment of centrifugally cast stainless steel digester piping off to Prince Rupert to handle cooking acid.

6. There are no parting lines: this results in better adherence and a reduced finishing cost.

7. Castings are considerably cheaper, because the process lends itself to the use of mechanical equipment that can be controlled electrically or pneumatically. This allows automatic (or semi-automatic) cycling and control.

8. There is no need to use a full length core.

9. To produce a hollow component from solid bar calls for extensive machining; not so with centrifugal casting.

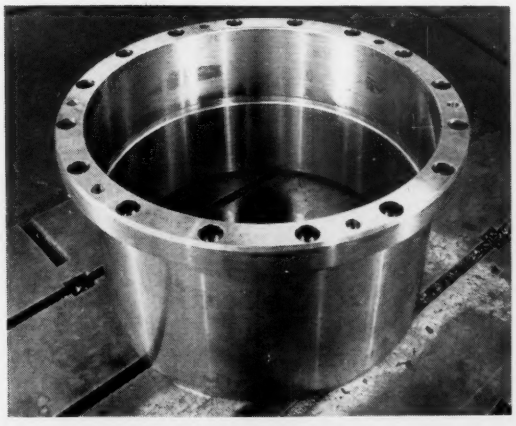
10. Machine parting into short sections is made easier, since only a hollow section is involved.

Dual metal rolls. Although many thousands of satisfactory grinding rolls have been made by the static casting method, there is a basic problem which has at times given serious difficulty. With the use of a single material, the uniformity of depth of chill is difficult to control, thereby making the useful grinding life of a roll sometimes less than expected. At other times, some cementite is formed through the entire cross-section of a roll, reducing the strength-toughness ratio and making it extremely difficult to bore the inner portion of the roll. For some chill roll service requirements, the use of certain alloying constituents in the white iron portion might be desirable but, in conventional or compromise casting, they could have a bad effect on the core metal.

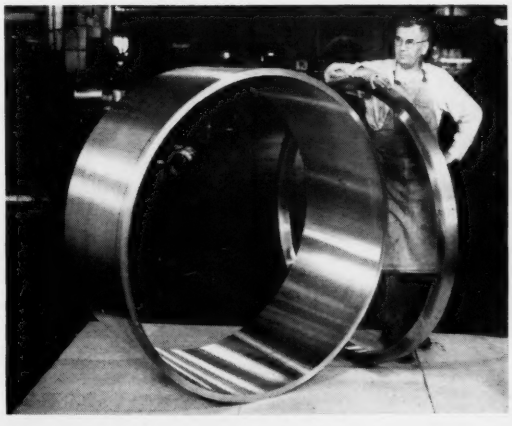
These difficulties have been overcome by the use of a dual metal roll. The outer part of the roll is cast from an iron composition specially tailored to avoid the possibility of mottle formation and lending itself readily (by compositional adjustments) to a chill layer of controlled hardness and predetermined thickness. The inner portion of the roll is cast from an iron melted in a different furnace and of quite different composition, so tailored as to preclude the possibility of forming free aggregates of unmachinable cementite. Again, by suitable formulation, the mechanical properties of the core metal can be varied to suit the needs. The casting process ensures a bond as strong as the metals involved, and the concentricity of the two layers is adequate for the needs involved. These dual metal grinding rolls have been made in considerable quantity by U. S. Pipe and Foundry Co., and their field performance has been very good. The diagram overleaf is a cross-sectional view showing the chill and gray iron zones and comparative hardnesses.

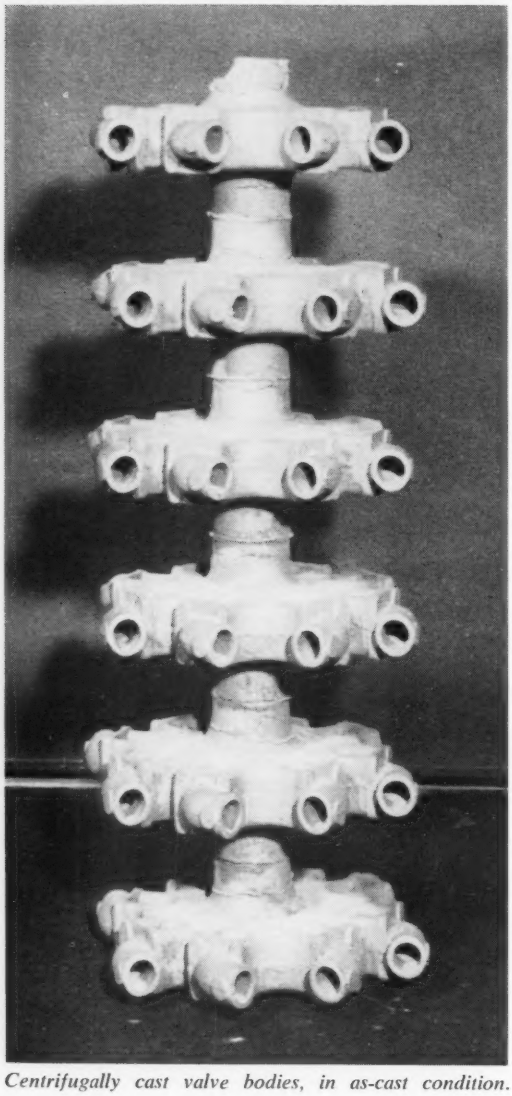
In summing up the advantages of the centrifugally cast dual metal roll, the following may be mentioned:

Bronze bearing cast for a 50,000 ton forging press.



54 in. bronze liner and seat ring for hydraulic valve.





Centrifugally cast valve bodies, in as-cast condition.

Advantages of dual metal rolls

1. The depth of clear chill can be varied at will, simply by changing the weights of hard and soft iron employed.

2. Since the two irons come from two separate melts, compositional adjustments (or alloying of either the chill layer or core metal) can be carried out without affecting the other.

3. Centrifugal force (acting during the freezing interval) ensures a sound and dense outer chill layer.

Typical examples. Centrifugal casting is being carried out by these companies: American Brake Shoe Co. (National Bearing Division); Anthes-Imperial Company Ltd. (Tru Spun); Canadian General Electric Co. Ltd.; Canada Iron Foundries Ltd.; The Canada Metal Company Ltd., (Roto-Cast Company); Esco Limited (Spuncast); Shenango Furnace Co.; William Kennedy & Sons Ltd. (Centricast); and Shawinigan Chemicals Ltd. (Permaspun).

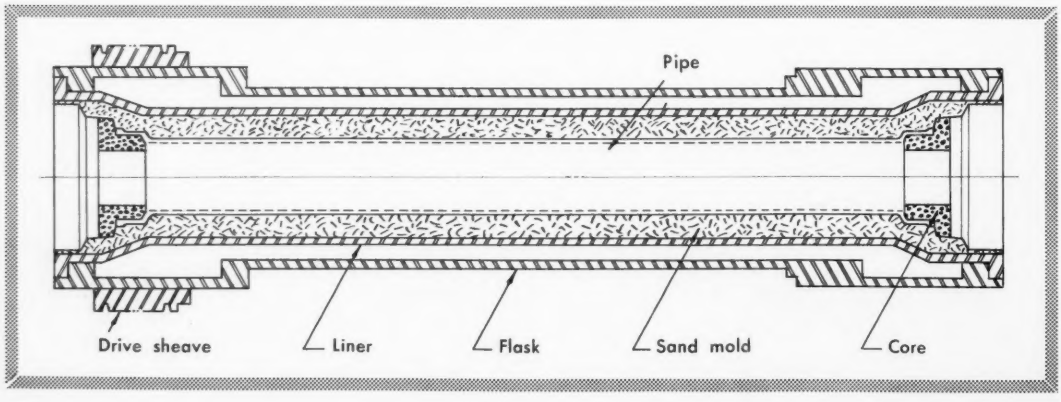
American Brake Shoe Company casts a broad range of copper base alloys, including the high-tensile manganese bronzes and aluminum bronzes, as well as the hydraulic, gun and bearing bronzes and brasses.

Shenango, in addition to casting ordinary bronzes, does centrifugal casting in phosphor bronze, silicon bronze, aluminum bronze, monel metal and special alloy irons.

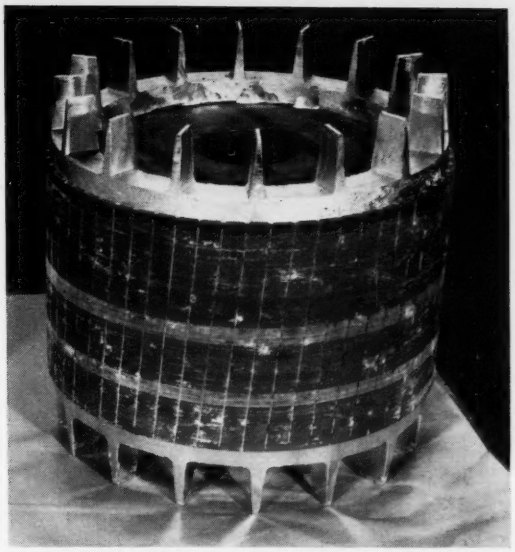
William Kennedy makes steel electric motor bodies, heat-resisting steel retorts, bronze marine tail shaft liners, gear blanks, bearings and bushings.

C.G.E. (Peterborough) makes aluminum induction motor rotors in a vertical centrifugal casting machine whilst Anthes-Imperial makes double-hub soil pipe in an automatic machine.

Esco Spuncast straight tubular castings, and special shapes adaptable to the centrifugal process, are produced in a wide range of alloys to resist corrosion, heat, impact and abrasion. High alloys (up to and including pure nickel) are a specialty. Spuncast pipe made in stainless 18-8s (Type 304), 18-8SMo (Type 317) and 18-8Cb (Type 347) is regularly carried in stock. Other alloy compositions can readily be furnished if desired.

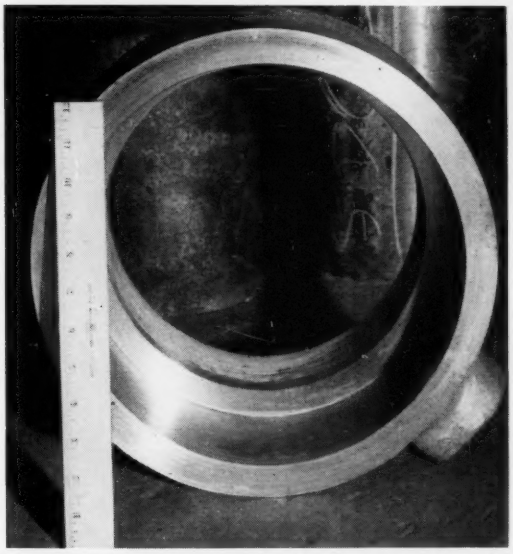


A flour mill roll with a hard white iron outer layer.



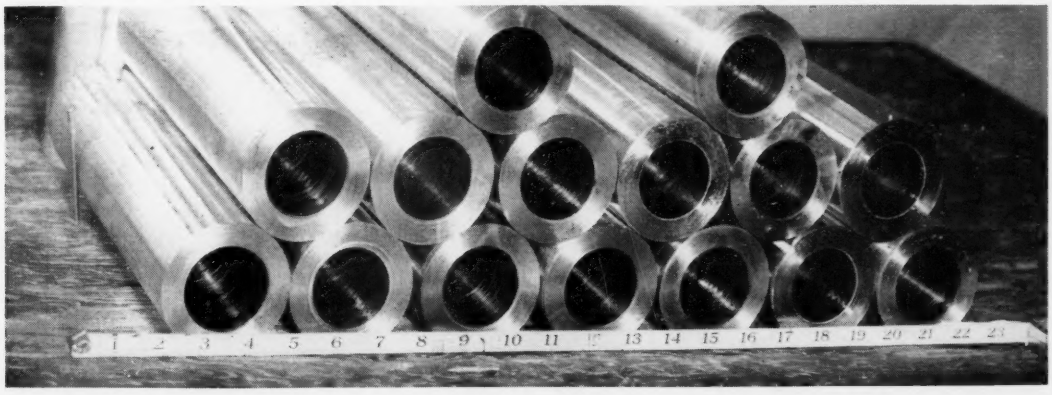
99% pure aluminum rotors in their as-cast condition.

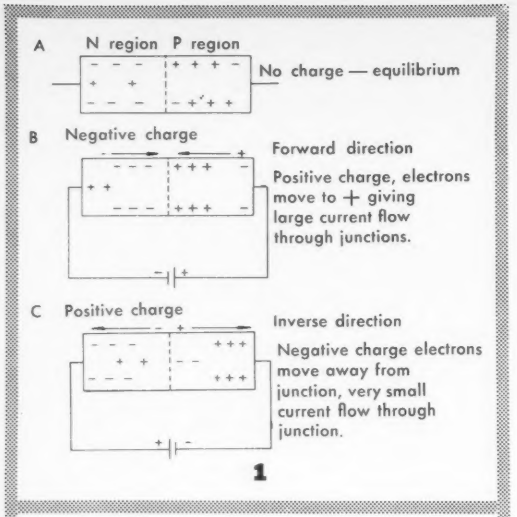
Wear plate and bearings from earth moving equipment.



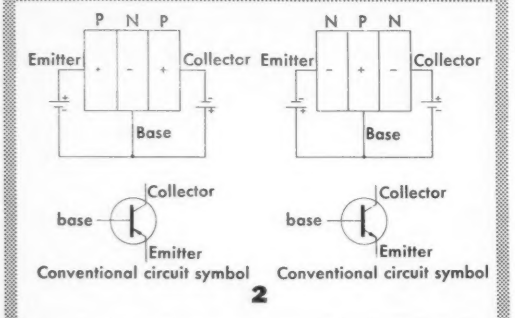
A contoured casting having a boss on one side only.

These are cage blanks for roller bearings. Of manganese bronze, they are made in a horizontal axis machine.




A
N region P region
No charge — equilibrium
B
Negative charge
Forward direction
Positive charge, electrons move to + giving large current flow through junctions.
C
Positive charge
Inverse direction
Negative charge electrons move away from junction, very small current flow through junction.

1



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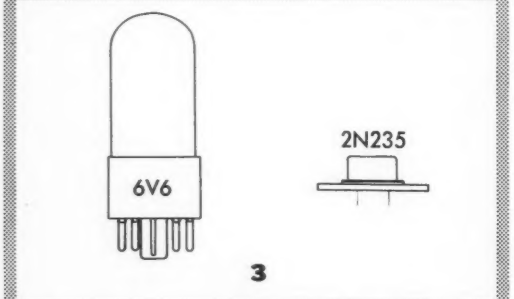

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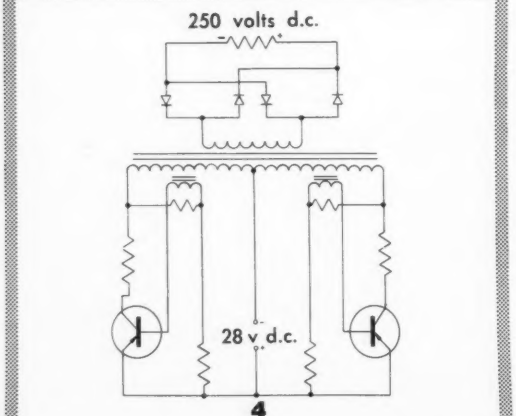


4

Transistors

Their theory of operation and an explanation of some applications

Larry S. Eggleton

Like many modern devices, the transistor is applying new techniques and understanding to an old principle. The combination of crystal and cat's-whisker (used as a detector in early radio receivers) was the forerunner of the germanium diode rectifier, from which transistors were developed. Although the crystal detector was mechanically so simple, a satisfactory explanation of its behavior was not possible until more was known about the atomic structure of matter and the movement of electrons in semi-conductors.

For general electrical purposes, matter can be regarded as composed of two classes: conductors and insulators. **Conductors** are mainly metals, with an atomic structure that has a large number of "free" electrons not locked in the atomic lattice. A perfect **insulator**, on the other hand, (should such exist) would ideally have no free electrons at all. The number of free electrons is therefore a measure of the conductivity of a substance. The application of electrical potentials to conductors, causes large migrations of electrons toward the positive end, thus giving the effect of electric current flow. In perfect insulators, by contrast, no free electrons exist to migrate and the application of voltage therefore has no effect. Between these two extremes of conductor and insulator lies the range of materials known as semi-conductors.

The metal germanium has proved to be one of the more satisfactory substances from which to make transistors. In its pure state it is actually an insulator, for it has four valence electrons and forms a bond between its atoms with no free electrons. It has, however, proved itself susceptible to the introduction of controlled quantities of impurities to make it semi-conductive.

If the impurities consist of the elements phosphorus, arsenic or antimony: these (having five valence electrons) will upset the atomic lattice of the germanium

The enthusiasm understandably generated among electronics men by the transistor has failed to rub off on designers in other fields, absorbed as they are in problems of their own. The purpose of this article, then, is to show the theory of operation of this device and illustrate some of its uses.

and introduce one free electron per atom of the impurity. The electron carries a negative potential and therefore germanium with this impurity is known as N type. Conversely, germanium contaminated by boron, aluminum, gallium or indium (which have three valence electrons) is deficient one electron per atom of the impurity, and is therefore positive. This type of germanium is known as P type. The progenitor of the junction transistor was the germanium rectifier, composed of a germanium crystal with N and P type regions in juxtaposition.

Fig 1 shows the sequence of events under three electrical conditions in a P-N junction. The P-N junction is an excellent method for the rectification of alternating current, for maximum current will flow only during the positive half cycle. The hitherto unchallenged position of the electron tube in the field of electrical amplification was due to its ability to influence the flow of a relatively large electron current by means of a small voltage applied to its control grid.

Fig 2 shows how this amplification effect can be reproduced by a "sandwich" of two P-N junctions. In the P-N-P transistor, negative polarity is applied to the collector, which (being a P region) is thus operating in its inverse direction with very little current flow. The emitter, however, is positively biased, but being also a P region, operates in its forward direction, causing current to flow. Whilst the emitter current is relatively small it had (by causing electrons to move from base to emitter) left spaces or "holes" for electrons to move in the collector base circuit. This current movement is large compared with the small base emitter current causing it. In this way, an amplified image of base emitter current changes can be obtained in the collector base current.

So far, so good, but at this point we have succeeded only in duplication of the amplifying properties of a vacuum tube. A comparison of power consumption and size factors, however, between types of vacuum tube and transistors of equivalent power output, vividly illustrates the reason for the enthusiasm for transistors.

The type 2N235A transistor, for example, has a power output comparable to the well-known 6V6 output tube, much used as an audio-amplifier. Table 1 compares the power input requirement of this transistor with those of the 6V6GT vacuum tube, for the same power output. The sizes are compared in Fig 3.

These comparisons emphasize the advantages to be obtained by the use of transistors, particularly in the design of airborne equipment. Apart from the more obvious advantages of weight and space reduction, designers are also presented with a method of reducing the heat dissipation factor. In addition, the reliability of a transistor is now greater than that of a vacuum tube. Its elements are relatively solid when compared to the tube's delicate grid and filament assemblies. There is, moreover, no hot cathode, capable of gradual deterioration. In a vacuum tube (apart from the heat generated by passage of the plate current through the electrodes) there is also a lot of heat generated because the filament must be kept red hot. In Table I, the power used in heating the cathodes amounts to 31% of the total power consumption of the tube. By doing away with this quantity of electrical power, we not only save the cost, weight and space required for its power supply equipment, but also that of cooling equipment to remove the excess heat.

Whilst air-borne equipment is at present the chief beneficiary, it will not be long before electronic computers are completely transistorized. The saving in the cost of filament supplies for several thousand vacuum tubes alone would justify this step, even if not assisted by cost reduction in the size of the floor area, and the smaller air-conditioning system needed to keep the ambient temperature down to operating levels.

Do not assume, however, that the transistor can directly replace tubes in existing equipment. The transistor is basically a current amplifier, whilst the vacuum tube is a voltage amplifier. Transistors therefore require entirely different circuitry, particularly as regards operating impedances and high current, low voltage power supplies. This latter factor makes them particularly desirable for the 12-volt dc systems of automobiles or the 28-volt dc systems of aircraft. It is thus certain that the transistor will appear more often in newly designed electronic devices.

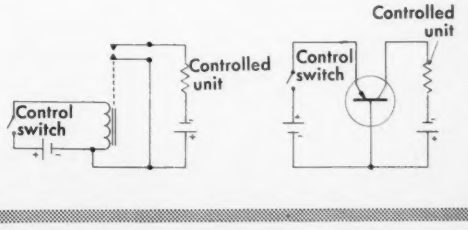
Even in the field of vacuum-tube operated equipment, however, the transistor can make an indirect contribution by providing lighter and more efficient power supplies. This increased efficiency is highlighted by transistor methods of changing low voltage dc supplies (6, 12 or 28 volts) to high voltage, low current dc suitable for vacuum tube plate supplies.

The two conventional methods (dynamotors and vibrators) both suffer from comparatively low efficiency, electrical and mechanical noise and moving parts which eventually wear out. Fig 4 shows a typical transistor power supply which would have an efficiency factor of 80% compared to 50% for a dynamotor, and a weight reduction of from 1/3 to 1/4. Transistors can also be regarded as an electronic equivalent of electro-mechanical relays, widely used in remote control applications. The simplified diagram (Fig 5) shows the replacement of a relay by a transistor.

This control application of transistors has proved to be of great value in digital computers, where all operations are reduced to the form of logic blocks of the *AND, OR, NOT* variety. These computations were actually performed by relays in some of the very early models, but were soon superseded by vacuum tubes. The advent of the transistor, however, is leading to the logic block circuit as a physical entity, with the

Table 1. Power Comparison

2N235A Transistor		6V6GT Beam power tube	
Base emitter current .008 amp		Plate current .030 amp	
Multiply by voltage .30	.0024	Screen current .004 amp	
Collector current .420A			.034 amp
Multiply by voltage 14.00	5.88	Multiply by plate volts 180	6.120
Power consumption (watts)	5.8824	Heater current .45 amp	
		Heater voltage 6.3 volts	2.835
		Power consumption (watts)	8.955



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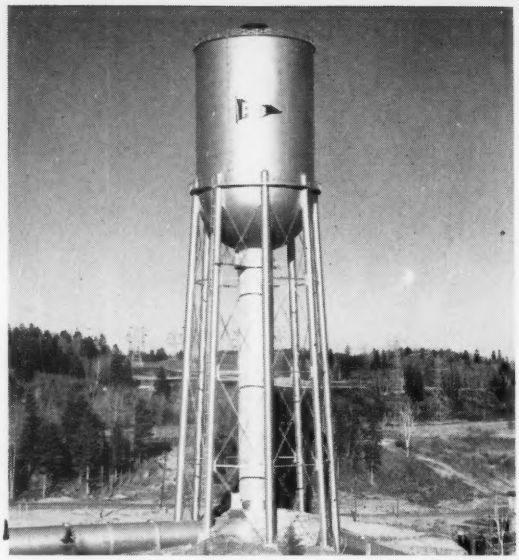
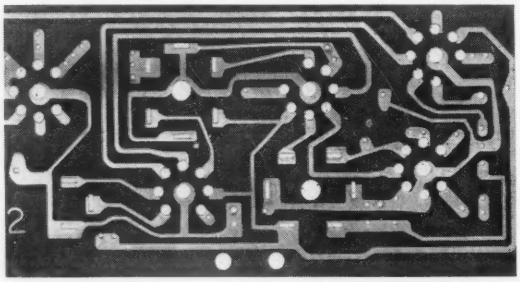


Towering 250 ft over the timberlands of Northern Quebec is the largest differential surge tank built in North America. It has 1,628,000 gallon capacity. (201)



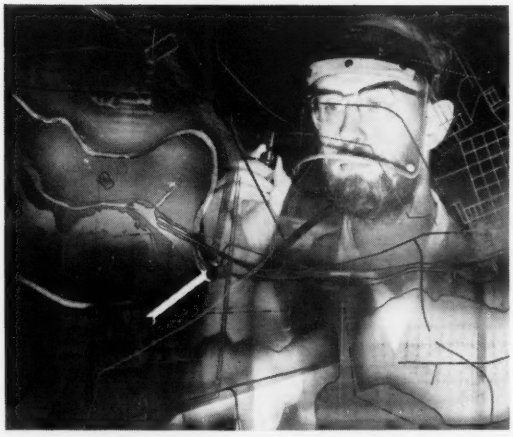
High impact strength of this phenolic laminate makes it well suited to printed circuit applications. (202)

Design news in pictures

World's largest circular building (in Baton Rouge) is nearing completion. It is constructed of 321 hexagonal panels here being painted in a bright yellow. (203)

Happy combination of tradition and function is shown by these vitreous enamelled cast iron casseroles. (204)

Mains/battery portable from the UK has molded cabinet in grey plastic, maroon fabric and gilt trim. (205)



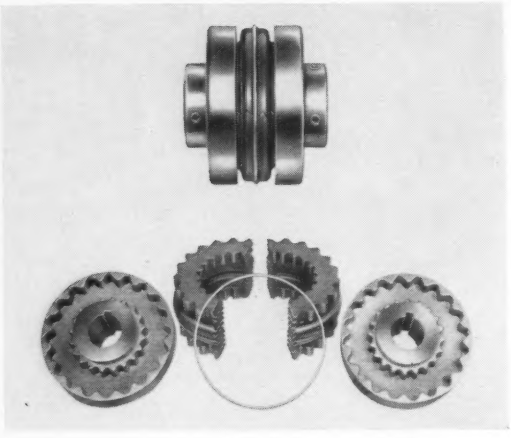
Putting finishing touches to giant 16 ft x 9 ft map of the Seaway he has sculptured in Plexiglas for Ontario Hydro is designer (& Irishman) Maxwell Moffett. (207)

Experiments continue in the development of hear-see telephones. Transmitter and receiver are shown. (206)

Ideas round-up

Flexible couplings:

it absorbs vibration and shock



Sure-Flex couplings are designed to give dependable power transmission whilst withstanding all combinations of misalignment and end float. The coupling (it is made by T. B. Wood's & Sons Co.) has exceptional torsional flexibility. It absorbs vibration and shock and thus gives smoother operation of both driver and driven equipment.

The couplings are easily installed and are unaffected by abrasives, dirt or moisture. There is no wear, and no need for lubrication or maintenance. Operation is noiseless.

The couplings have exceptional torsional flexibility: 15 deg at peak torque compared with 1 to 3 deg for other types.

The coupling consists of two flanges and a two-piece flexible rubber sleeve. The teeth of the sleeve-halves lock into the teeth of the flanges without clamps or screws, tightening under torque to provide a smooth transmission of power.

They take angular misalignment up to 1 deg, parallel misalignments up to 1/16 in. (depending on shaft size), and free end float up to ⅛ in. (depending on coupling size). Destructive overhang loads are not placed upon driver or driven shafts, and this gives longer bearing and shaft life. Angular or parallel misalignment does not generate unbalance or pulsations, as all flexing takes place within the rubber sleeve. (208)

Plastic molder: ideal for testing experimental designs

The jet plastic molder, produced by Unex Laboratories, was designed to produce experimental or short runs of small parts in the shop. It provides an ideal method for testing experimental parts (or new designs) before ordering expensive production dies.

The molder is a compact, portable unit (it weighs 100 lb) sturdily constructed for long service. Quick setup and rapid production of parts are two of its features. Die sets can, in fact, be exchanged in less than a minute. Interchangeable low-cost injection cylinders can be installed so that a quick change in plastic materials and colors can be made. Since most orders for injection molded parts specify more than one color, this is an outstanding feature.

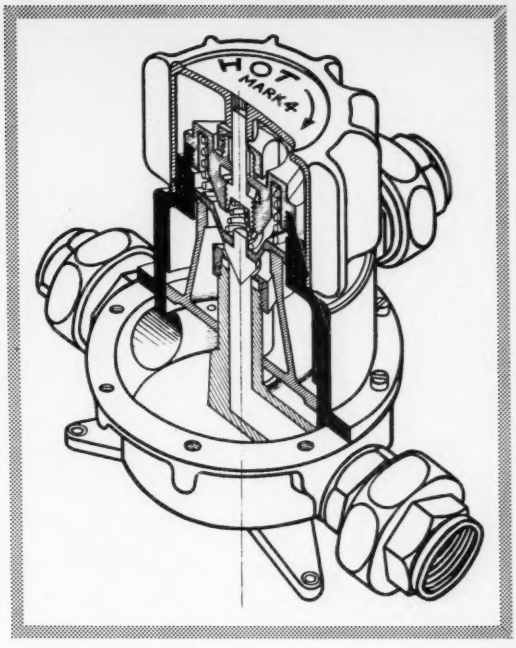
The molder has a maximum shot capacity of about ½ oz or ¾ cu in. A hopper receives the charge of granular pellets. Operation of the injection lever actuates a mechanical toggle linkage that exerts a molding pressure up to 20,000 psi.

The machine can mold all thermoplastics, including nylon; no special operator skill is required. Normal production is 1 to 3 cycles per minute, depending on the material used. Heating current is 600 watts at 110 volts ac/dc. A thermoswitch control maintains the operating temperature within 5 deg over the molding range of 200 to 600 F. A removable dial indicator thermometer provides a constant reference for settings. (209)

Steam water heater

The Meynell steam water heater instantly mixes steam and water in the correct proportion to suit the demand, and positively guarantees against scalding. It ensures automatic and positive isolation of higher pressure steam from water, when the outlet flow is interrupted. It may be operated where either or both of the inlet services reach 150 psi, and will operate on inlet service pressures up to 150 psi steam and 5 psi water (or vice versa), with remote multi-point control of outlet flow. The only moving parts are the piston and nickel valve, the former having a stroke of ¼ in. No rings or seals are necessary. The internal steam passage is thermally insulated to prevent the formation of lime deposit.

The nickel valve is held by a circlip, and is easily replaceable. The seat is a washer, easily removed and replaced. It has a very long life under high pressure/temperature conditions. All springs are of stainless steel and deterioration is practically nil. The valve spindle is protected against side strain and shock by the design of the knob in which it travels, and it is lubricated automatically. The stuffing box and gland assembly are of orthodox design and are easily adjusted after removal of the snap-on cap. (210)

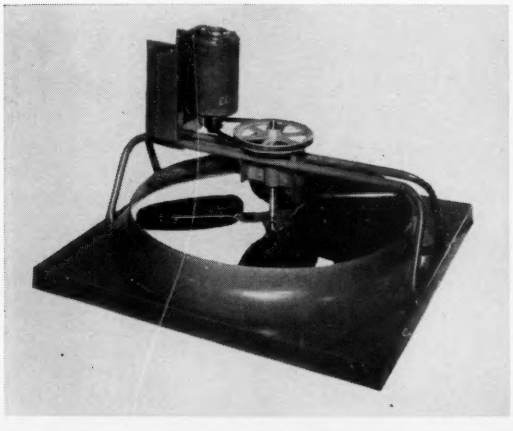


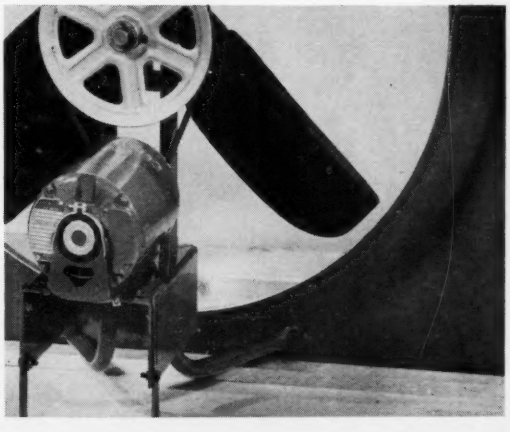
Attic fan: it can be placed in cramped spaces

Live-Air, a new attic fan line in the 600 Series, has been introduced by Viking Air Products. The fans have a capacity range of 3,100 to 13,000 cfm. To meet these requirements, the blade diameters are 22, 30, 36 and 42 in. For example, in northern latitudes, a 22 in. fan with a capacity of 3,100 cfm will cool a home of 6,500 cu ft; a 30 in. fan, 14,000 cu ft; a 36 in. fan, 17,000 cu ft; and a 42 in. fan will cool a house up to 26,000 cu ft.

The variety of uses and installations for the fans is limited only by the imagination. Modern home builders and fan installers are combining attic fans with air conditioners for low-cost, efficient cooling. They're installing attic fans in attached garages, basements, attic knee-walls and many places where "live-air" cooling is needed. Streamlined and compact, the fan can be located in cramped, unused, and otherwise wasted space. Their low silhouette makes them ideal for attics where headroom is limited.

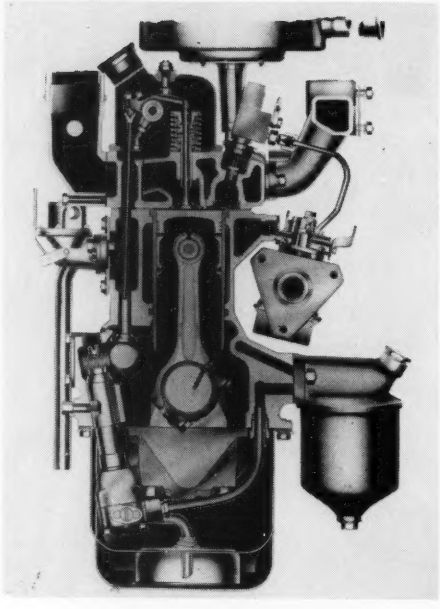
A specially designed motor mounting bracket permits the fan to operate in either an upright position (for horizontal air discharge) or in a horizontal position (for vertical discharge). A complete size range of spring-tensioned shutters and timer switches is available. (211)





Diesel engine:

product of six years' research



Six years of research and development (and over a million miles of road tests under all conditions) have gone into a lightweight diesel engine claimed to give the average car unheard-of performance and running economies. This new 1.6 litre engine is very compact, weighs only 320 lb and develops 43 bhp at 4,000 rpm.

In official tests (conducted by Britain's Royal Automobile Club) a Vauxhall Velox fitted with the engine averaged 56.6 mpg at an average speed of 34.8 mph and a Ford Consul did 50.8 mpg at 34.7 mph.

Made by F. Perkins Ltd., the engine enters a field previously held exclusively by the petrol engine.

Until now there has not been a diesel engine with comparable performance and noise level. Among the attractive features of this "Four 99" engine are the big mileages possible without major overhaul. One test included 3,000 hr continuous running (equivalent to 90,000 road miles) at the end of which all components were found to be in perfect condition. Press-button starting is a boon in cold weather. (212)

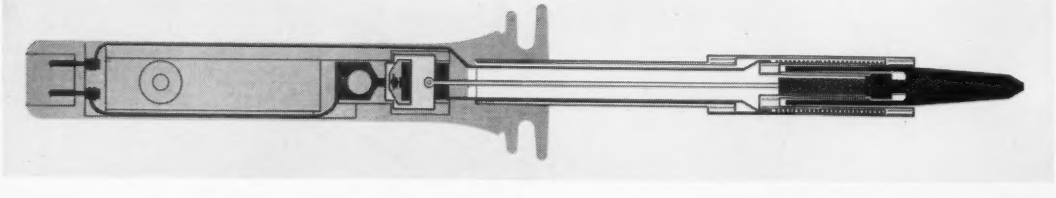
Soldering iron: constant temperature with unusual thermostat

The use of magnetic force for the automatic control of soldering iron temperature is the principle employed in a new iron manufactured by Weller Electric Corporation. Called the Magnastat, the iron is believed to be the first to employ this unusual principle, which depends on the magnetic quality of a special alloy. At a predetermined temperature, the alloy loses its magnetic qualities, but regains them at some other known temperature.

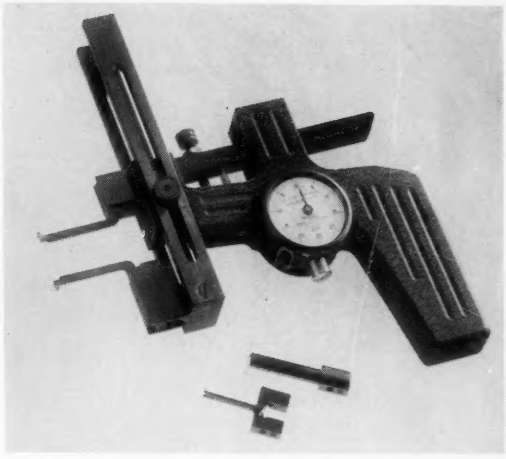
The soldering iron's temperature is kept near 700 F. When the heat at the tip of the iron changes, a sensing element there changes its magnetic qualities and either makes (or breaks) electrical contact. Thus the current flows (or cuts off) as desired.

The soldering iron is made of a series of stainless steel tubes which protect the sensing mechanism and make the iron stronger and longer-lasting. The stainless steel and parts of the interior workings of the new iron are supplied by Allegheny Ludlum Steel Corporation.

The temperature at the soldering tip is controlled to $\pm$ 2%. By controlling the heat, the soldering tip does not become oxidized or pitted like other irons, and thus has a much longer life. Also, it is not necessary to dress (or reshape) the tip as often as other types of iron. (213)



Gauge: for inside measurement of O-ring grooves



From the **Mueller Laboratory** comes this lightweight pistol grip gauge for the inside measurement of O-ring grooves, snap ring grooves and bores.

The gauge can handle inside measurements from .187 in. to 6.875 in. inclusive and can be set with micrometers, or gauge blocks. The actual measuring is totally independent of any finger pressure (eliminating human error) and the indicator is completely protected. By reversing slide, the gauge becomes an outside measuring gauge when using outside measuring tips. (214)

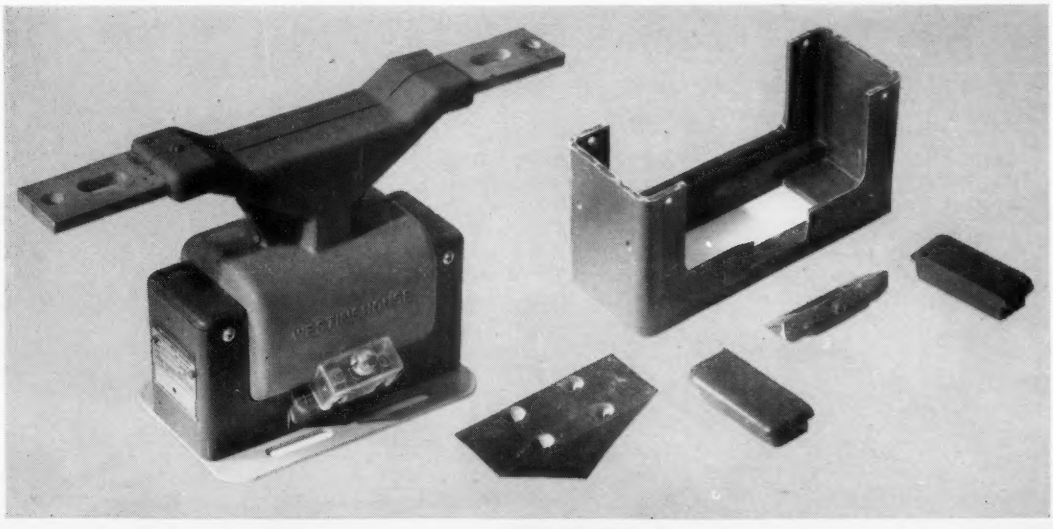
Transformer: it uses glass fibre reinforced polyester

Savings in assembly time and cost (and improved appearance) were obtained by Westinghouse design engineers in a new transformer that uses five molded parts of Thermaflow glass fibre-reinforced polyester.

The SM 8.7 transformer (designed for indoor metering and relaying applications) takes 30% less time to assemble and weighs 20% less than the former model. Westinghouse achieved these savings because there are no strapping operations. The spacer block anchoring the primary contacts is merely bolted to the transformer body and covered with silastic rubber insulation.

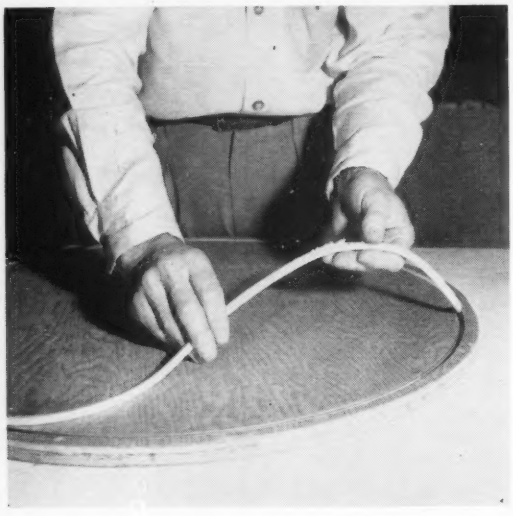
The transformer's low voltage terminal block (as well as the casing and two end caps) are molded from Atlac Thermaflow 2400, a strong, light polyester that resists shock and won't corrode or absorb moisture. The largest single part in the assembly is the case, which replaces several welded metal parts that formed the base and cradle of the old model. The SM 8.7 bolts to the casing quickly and easily. The V-shaped spacer block in the primary circuit is molded of Thermaflow 500, a high strength, electrical grade material.

The apparatus withstands electro-mechanical stress of 100 x normal, and heat intensity of 85 x normal. Its rating factor is 1.5 overload, continuous operation. (215)



Silicone rubber gasket: do-it-yourself production

True-Scale Inc. needed special seals for their epoxy-glass compression and vacuum molds, used to produce an ever-increasing variety of polyester-glass prototype parts. Even custom-molded seals of ordinary rubber were too expensive for these special molds, especially in proportion to the few plastic parts required per individual prototype mold.



The company tried various kneaded mastics, only to have them deteriorate badly upon contact with the polyester resin. Then they tried Silastic RTV, the new **Dow Corning Silicone** rubber that vulcanizes without heat or pressure.

Here's how they did it: first a groove of the proper diameter and cross-section was routed out of birch-faced plywood. After sanding and sealing, the groove was rubbed down with plain wax for easy release and a smooth finish, and was poured full of RTV. The pouring was allowed to set overnight. The overflow was then trimmed off and the finished seal taken out, smooth and bubble-free, ready to go to work. No further curing was required.

True-Scale points out that the grooves could just as easily be rectangular (or V-shaped) as U-shaped, that the ring could be any configuration (not just circular) that two D-seals could be cemented together to make an O-ring, and that the seal could be reinforced if necessary with a ply of glass tape between layers. They themselves prefer the softness of the plain gasket, because it helps give a more positive seal. (216)

Continued on page 86

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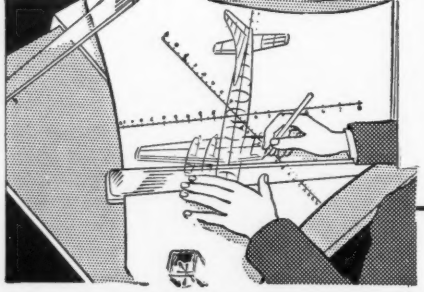

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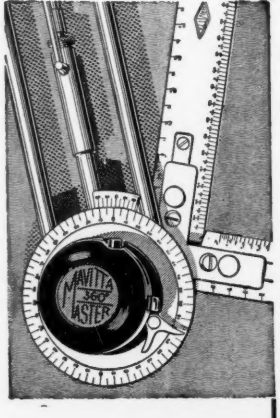

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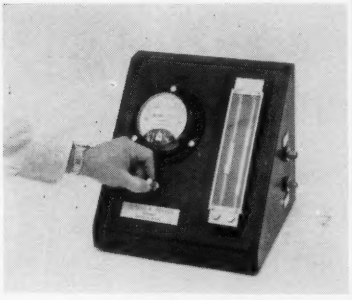
New Products

Low flow meter

A new meter which measures, calibrates and flow-sets low flows of gases and vapors has been introduced to the market by **George K. Porter Inc.** Developed to measure flows as low as 1cc/hr and up to 10cc/min or higher, this precision



flowmeter is claimed to fill a need which has existed for many years in low flow measurement.

The Micro-Flow meter has three basic uses as follows: to measure and indicate flows from small flow region to micro-flow region, as a low flow calibration unit, as a flow setting system in establishing specific flow rates. (217)

Continued on page 73

Transistors

(continued from page 61)

transistor and all associated components in a "potted" module, to be plugged in as required.

Until a few months ago, one of the advantages the vacuum tube still had over the transistor was its ability to amplify radio frequencies up to about 500 megacycles. The best upper frequency limit attained by standard transistors at the time of writing is approximately 70 megacycles. Progress in transistor technique is, however, so rapid that this figure may soon be superseded. Even as we write, the frequency advantage of the vacuum tube is being threatened by an experimental type of transistor, the "spacistor," for which the manufacturers claim an upper frequency limit of 10,000 megacycles.

Although the vacuum tube is still not faced with immediate oblivion (particularly in the high power ranges of 1,000 watts and up) nevertheless, as transistor research presses on, it may one day become a museum piece. ★

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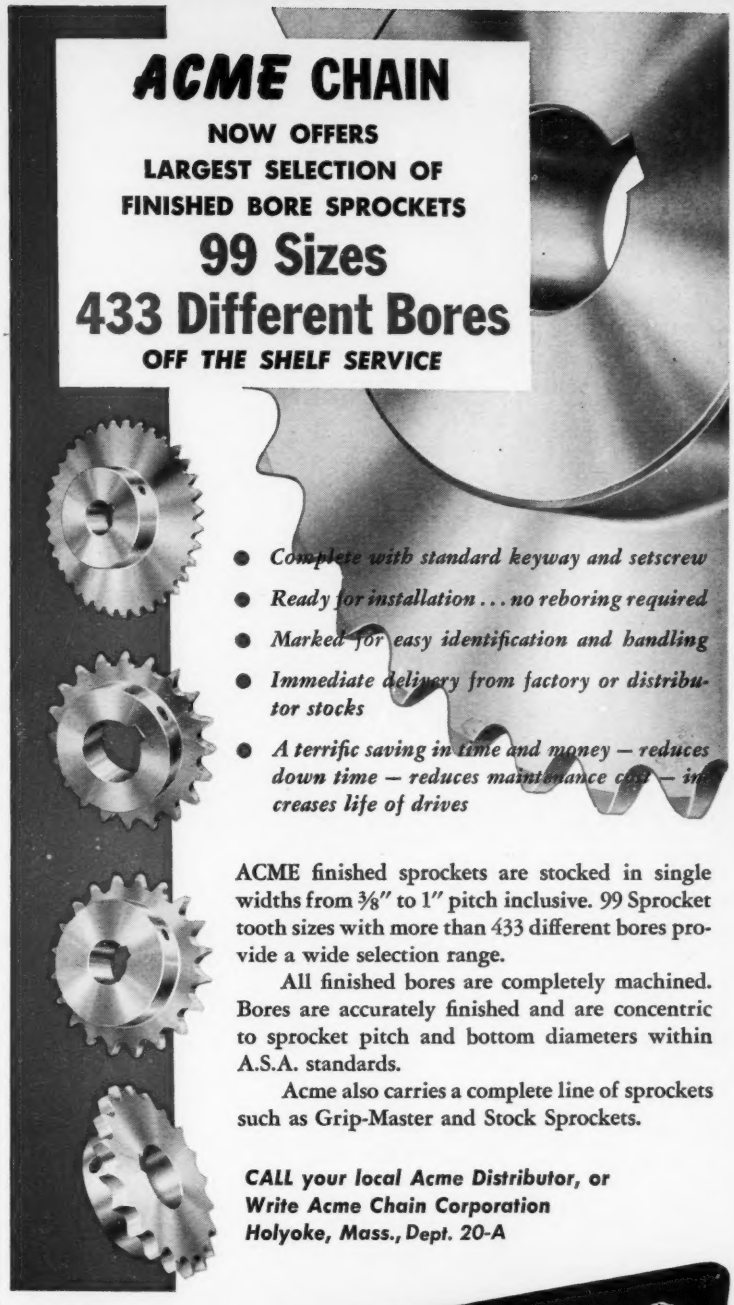

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- *Ready for installation . . . no reboring required*
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ACME finished sprockets are stocked in single widths from 3/8" to 1" pitch inclusive. 99 Sprocket tooth sizes with more than 433 different bores provide a wide selection range.

All finished bores are completely machined. Bores are accurately finished and are concentric to sprocket pitch and bottom diameters within A.S.A. standards.

Acme also carries a complete line of sprockets such as Grip-Master and Stock Sprockets.

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COMPLETE LINE OF ROLLER CHAINS AND SPROCKETS • DOUBLE PITCH CONVEYOR CHAINS • STAINLESS STEEL CHAINS • CABLE CHAINS • FLEXIBLE COUPLINGS • STANDARD AND SPECIAL ATTACHMENTS

"Torque-free" is this bearing's boast

Its electromagnetic device tends to cancel out the friction torque

The dynamic bearing (see above) is an electro-magnetically powered ball-bearing assembly developed by The Barden Corporation as a rugged, practical support bearing with as little resistance to rotation as possible.

As far as can be determined by tests conducted over the past months, the bearing is torque free, except for minor viscous effects. Running torque is lower than the lowest torque of presently available bearings. Starting torque is equal to running torque.

In operation, an electromognetic device oscillates the outer ring of the supporting bearing. This action tends to cancel out the friction torque resisting the rotation of the supported member. The effective resistance to rotation is the residual of clockwise torque. This residual is the restraint caused only by viscous effects, which is practically an irreducible minimum.

An external oscillator is required. Each unit of the size shown draws only a power of 1 watt. Thus the oscillator can be transistorized and quite compact.

Tests show that a low torque R3 ball bearing (of 1875 in. bore) operating under a 2 lb radial load has a starting torque of 350 dyne-cm and a running torque of 200 dyne-cm. Under the same load, a dynamic bearing of the same bore has a starting torque equal to its running torque, with both at a level below 25 dyne-cm.

For accurate positioning of the supported load, dynamic bearings can be preloaded, and the torque is still well below that of conventional bearings that are not preloaded.

Endurance tests showed no increase in torque of the bearing after 1000 hr operation in an open area without special protection.

Maximum benefits are derived at very low velocities, approaching zero rpm.

Applications will be found in gyro gimbals, scales, static balancing machines, gyro-stabilized platforms or other precision devices, where a low torque (but a rugged bearing) is needed.

The model shown, the first of a series, is designed for straddle mounting. Variations for cantilever mounting may be designed to suit individual applications. The bearings may be supplied in other sizes or otherwise modified to specific requirements. Various other features (such as shoulder mounting) can be incorporated.★

Reclaiming old drawings is just one of the jobs you can do with Kodagraph Autopositive Paper

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AS YOU CAN SEE, the drawing shown above is badly beaten up. Its line detail is weak, its background soiled from old age and considerable handling. And the blueprints and direct-process prints it produces are likely to be illegible.

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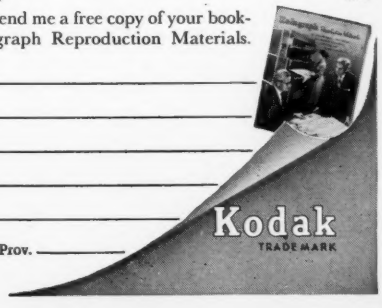
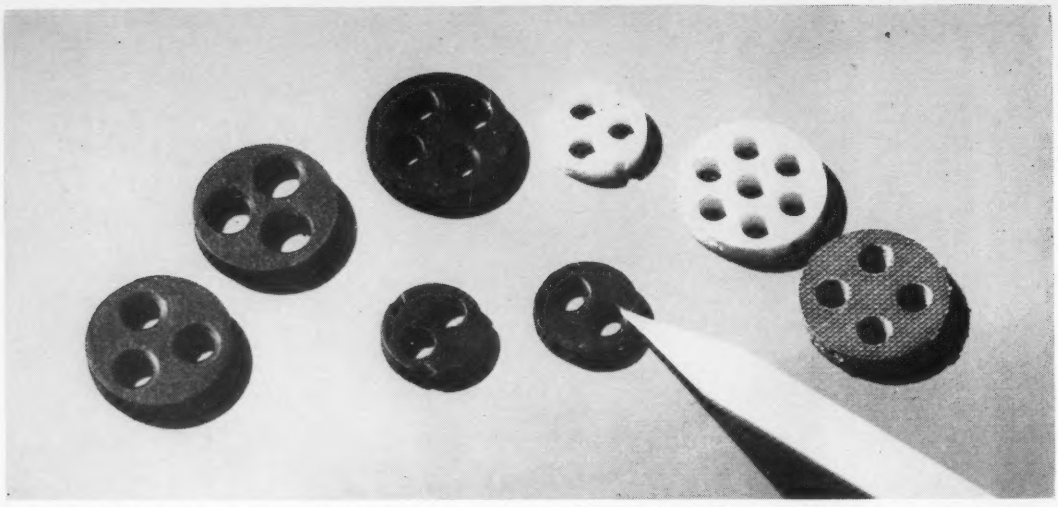




1. Caps fabricated from vulcanized fibre (black), glass and cotton base Phenolite (white and textured pieces).

Vulcanized fibre

Because they meet specifications for superior mechanical strength, high electrical insulating properties and cheapness, vulcanized fibre and two grades of laminated plastic are used as insulating caps for fire-resistant, mineral (magnesium oxide) insulated electrical cables. These caps (see Fig 1) insulate up to seven copper conductors from one another and from the copper covering of the cable shown in Figs 2 and 3.

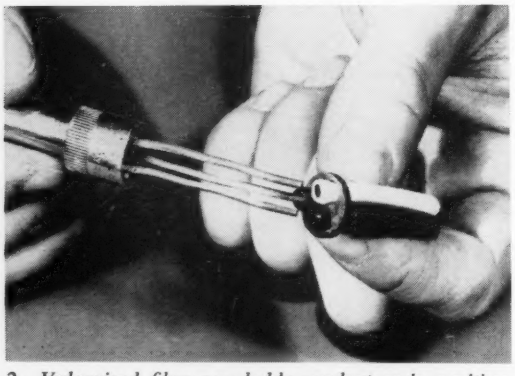
The fire-resistant cable is manufactured by Pyrotenax of Canada, Limited. It was developed in France and England and is believed to be the first new wiring method introduced to the Canadian market in the last 50 years. The cable is used for lighting, power and control wiring up to 600 volts, and may be operated at temperatures up to 482 F.

Three grades of National Fibre Co. of Canada Ltd. materials are now used in these cables. They are:—(1) vulcanized fibre for standard applications; (2) glass-base phenolite laminated plastic for high temperature applications; and (3) canvas base phenolite laminated plastic for applications requiring high moisture resistance.

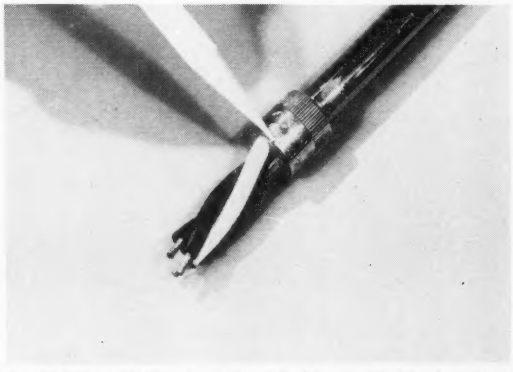
Vulcanized fibre caps are used for all standard applications, which represent about 95% of the mineral insulated cable applications. This service means that they must stand up to temperatures of 187 F.

For high temperature applications (in such places as steel rolling mills) the cables are equipped with insulating caps made from silicone-bonded, fibre glass phenolite laminated plastic. This material, with its high flexural and tensile strengths and superior electrical insulating properties, gives outstanding heat resistance. Pyrotenax recommends cable equipped with these caps for applications up to 202 F. and occasionally even higher temperatures. This again allows a safe temperature margin, because the glass-base phenolite caps will take continuous temperatures up to 400 F and short time temperatures as high as 500 F.

The caps for cables used under humid conditions are made from the CE grade of phenolite. This material (a cotton fabric bonded with phenolic resin) offers good electrical qualities and excellent moisture resistance. For example, after 24 hr immersion, a piece of this ½ in wide material will absorb only 0.5% water. ★



2. Vulcanized fibre cap holds conductors in position.



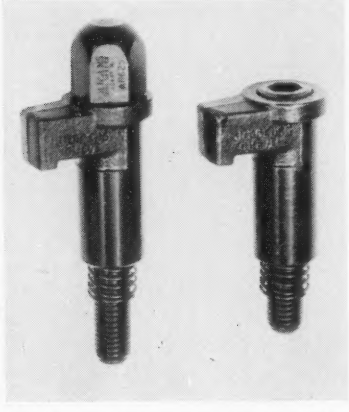
3. Cable end is crimped to hold cap firmly in place.

New products
Continued

Swing clamp assembly

A new line of forged swing clamp assemblies, manufactured by **Jergens Tool Specialty Co.** is now available in two styles for extreme clamping pressure in close quarters and gives the user a choice of fastening with socket head screw or nut.

The assemblies are completely forged with bodies ground to the top collar for



backing so clamps will not bend back under tension. For quick manoeuvring, the new clamp assemblies utilize spring loaded shafts which permit the clamps to swing quickly and easily out of the way of fixture and work. (218)

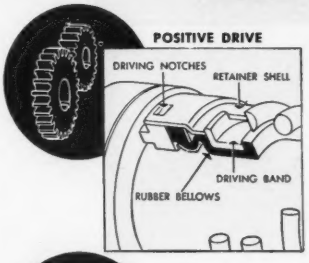
Shatterproof mirrors

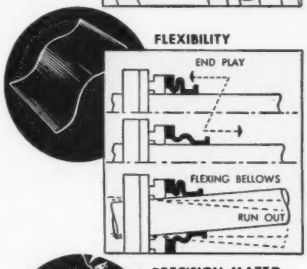
New plastic mirrors — produced by the **Homalite Corp.**, provide important advantages whenever safety and permanence are factors for consideration. Made of Homalite CR-39, a thermoset-

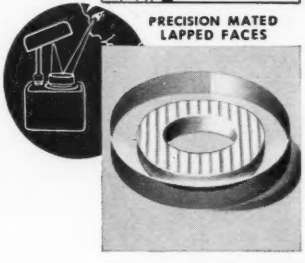
ting plastic, the mirrors have high impact strength and excellent scratch resistance, are resilient and lightweight and will not shatter. Permanent silver backing applied to the plastic gives a clear, sharp distortion-free reflection which will not oxidize or chip off.

Continued on page 75

JOHN CRANE **Shaft Seal Design With A Purpose!**







POSITIVE DRIVE

This gives long seal life. Drive is transmitted through the driving band and washer driving notch which absorb all breakout and running torque. Damaging stresses on the bellows or flexible sealing member are eliminated. Slippage is also eliminated, thus protecting shaft or sleeve against galling.

FLEXIBILITY

Axial and radial misalignment problems are eliminated. Self-adjusting bellows or sealing head automatically compensates for shaft end play or run out. Minimum spring pressure is required for axial shaft movement and uniform spring pressure is maintained during radial shaft movement.

PRECISION MANUFACTURE

Leakproof performance is assured. Washer and seat surfaces are precision lapped to a perfect mate under a patented "John Crane" process.

A SEAL FOR EVERY SERVICE

All "John Crane" Seals are constructed to the particular service requirements . . . from hot or cold water to the most destructive acids, corrosives and gases . . . temperatures up to 1000°F. . . . pressures to 1200 psi. They can be furnished in types and sizes to meet practically any mechanical or dimensional condition.

Request Bulletin 5-204-2. Containing full information on "John Crane" engineered shaft seals.

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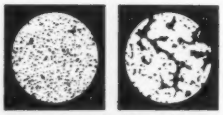
Words cannot describe the advantages and the superiority which BEARIUM METAL offers over all other types of bearing materials. Only when you use it under the most difficult operating conditions can you appreciate its amazing superiority.

So, if you have a bearing application which involves high speeds, poor lubrication, excessive loads, elevated temperatures, dusty and gritty surroundings—or where a liquid other than oil must be used as a lubricant ... BEARIUM METAL will prove to be your best investment.

THE SECRET OF BEARIUM METAL'S superiority is due to the uniform distribution of microscopic lead particles within the copper-tin grains rather than between the grain boundaries—as illustrated by these two photomicrographs.



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FEATURES: Non-Seizing and Non-Scoring • Long-Wearing • Self-Lubricating • Low Coefficient of Friction • High Compressive Strength • Resistant to Shock Loads • Sound, uniform structure • Free Cutting.

AVAILABLE IN: cored and solid bars • centerless-ground rods • machined parts • pattern castings.

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Briefs

We note with interest . . .

. . . that new Canadian legislation for protecting industrial designs (based on the British Registered Designs Act) has been recommended by the four-year-old Royal Commission on Patents, Copyrights, Trademarks and Industrial Designs. Copies of their report are available from the Queen's Printer in Ottawa . . . a new truck diesel engine from General Motors which makes liberal use of aluminum alloys and thus scales 750 lb less than its nearest competitor . . . the marketing of a rubber head which will slip onto a hammer and turn it into a mallet in seconds . . . Du Pont's claim to have developed a new line of red and violet pigments suitable for plastics, paints and printing inks. These have supposedly overcome many of the problems (bleeding, running, fading) associated with these popular colors . . . a German conveyor belt which can sidle round tight curves and lift its load up steep inclines . . . that a British firm has an electronic photographic enlarger which uses a scanning light beam from a cathode ray tube to obtain automatic shading and exposure control. This eliminates the conventional methods of "dodging" certain portions of the negative by hand . . . Cominco's announcement that it can now produce indium with a guaranteed purity of 99.9999% . . . Ontario's interest in an electronic signal system which "beeps" warnings to motorists when they are approaching a railway crossing or dangerous curve . . . a claim by Armstrong Whitworth that their Argosy turboprop (an 80-passenger, 300-mph "flying bus") makes air travel as cheap as traveling by train . . . reductions of from 13c to 18c a pound in the price of Zytel nylon molding and extruding resins by Du Pont . . . a hospital item from the U. K. with a lulu of a name. This is the Little Plumstead Patient Lifter. Little Plumstead is the English town where the machine was devised — patient lifting is what is does . . . the strengthening rumor that GM is tooling up for an air-cooled aluminum engine (probably slated for the Chevrolet) . . . conflicting claims from the world's makers of jet-engined passenger planes as to who's where first with the most . . . the pleased announcement from Copenhagen of an electronic atmosphere taster. This cuts an automobile engine at the hint of alcohol on the driver's breath . . . that C. D. Long of Spartan Air Services takes issue with us over a statement made in this column in a previous month. Says Long, "I think it would be more fair to say that the surgeons sounded the need for such a device (for stitching blood vessels), while the development was done by a team of engineers in the Division of Mechanical Engineering of the National Research Council" . . . a giant portable auditorium — called the Portatorium — that can be erected in a few hours and seat 1,000 people (unlikely to impress an old-time Barnum and Bailey man, we think) . . . Britain's hopes of having the world's first fleet of atomic merchant ships. Word has it that her scientists are already far advanced with a new type of nuclear furnace, having decided that the one in the U.S. atomic submarine Nautilus isn't suitable for commercial exploitation.

Computer conference

Sponsored by the Power Division of the AIEE, a three-day conference on computer application was held last month at the King Edward Hotel in Toronto. Its object: to discuss the best ways to use computers and the problems that arise when they are used.

The importance of the meeting can be gauged by the fact that the 275 delegates came, not only from Canada and the U. S., but from much farther afield: from Stockholm (Swedish Power Board); London, England (Queen Mary College); Nuremberg, Germany (Siemens-Schuckert Works); and Zurich, Switzerland (Brown Boveri).

The guest speaker at the dinner was Prof. Marcus Long of the University of Toronto.

Appointed . . .

Robert D. McCleary, Charles E. Scott and **G. M. Parker** as industrial products department representatives with the Sun Oil Co. Ltd.

James C. Nairn as manager of industrial sales for the Canadian Duff-Norton Co.

W. D. Bailey Jr., manager of Esco's foundry division, to the board of directors.

Frank Ross as sales engineer (electrical equipment) at the Montreal district sales office of Canadian Allis-Chalmers Ltd.

Donald W. Richardson to the assistant general sales managership of Leland Electric Canada Ltd.

Edward P. Geary, a director of Vanadium-Alloys Steel Canada Ltd., to a directorship and membership in the executive committee of the parent Vanadium-Alloys Steel Co. in Pennsylvania.

New products
continued

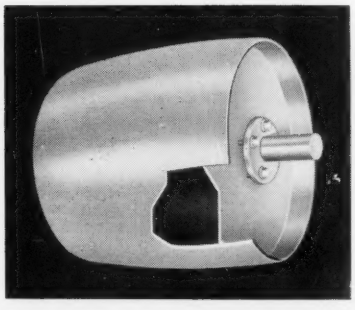
The mirrors weather well and do not craze or become brittle at low temperatures.

Because they stand up under usage that would destroy glass and are safe and lightweight, these mirrors are especially advantageous for use in automobiles and trucks, for handbag or luggage mirrors. (219)

Curve crown pulley

Stephens-Adamson engineers have developed a new pulley, known as the Curve-Crown pulley and incorporating new features of design and manufacture. It is claimed that the new pulley improves upon the features of the conventional taper crown and flat-face pulleys, and eliminates the disadvantages.

An absolutely round-rimmed pulley with a single seam, 100% welded on



both the outside and inside for maximum strengtht, the pulley is produced by a new forming process. The crown of the pulley is accurately formed on the outer ends of the rim, providing maximum training effect but eliminating belt stretch and wear, usually prevalent with the conventional high-centred taper crown.

The pulley also features a hub which effectively transfers loads from shaft to hub and from hub to rim and yet eliminates weldments between hub and pulley end plates. (220)

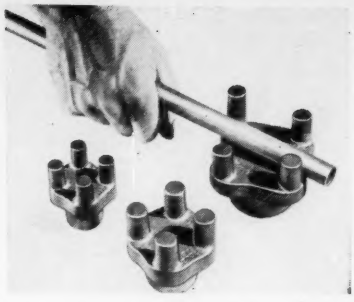
Portable crack detector

The **United States Casting Repair Corp.** has announced the development of a new, low cost, completely portable crack detector. Based upon the principle of magnetic particle inspection, the Seal-Lock magnetic crack detector will immediately and exactly locate and outline any surface crack or fault on any ferrous casting. The unit will even spot fine hair-line cracks that are invisible to the eye. (221)

Speed bar knobs

A new enlarged line of four-prong speed bar knobs is being manufactured by **Jergens Tool Specialty Co.** They feature fast action with maximum clamping pressure.

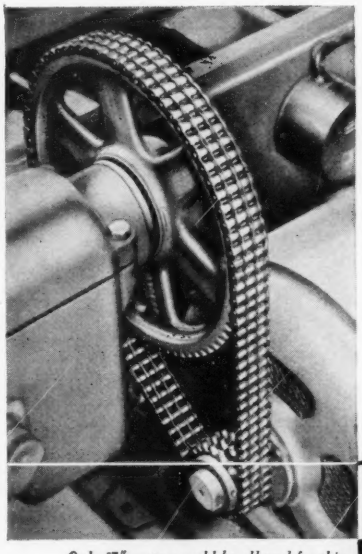
Made in 15 sizes, the bar knobs are easily turned by hand or with a bar or tool handle inserted between the prongs. Four



of the 15 sizes have extra long prongs for use with a crank handle and eliminate

Continued on page 80

A long run for your money



Only 17" centres could be allowed for this drive from motor to heavy machine and a RENOLD stock chain drive easily transmits the necessary power.

For conversions or new equipment specify **RENOLD stock chain drives.** Quiet, positive and smooth running, they will give you years of dependable, trouble-free service, outlasting other types of transmission many times.

Drives from fractional to 140 h.p. can be supplied **FROM STOCK** in 25 different ratios, easily selected from chart in our Catalogue Ref. 116/93

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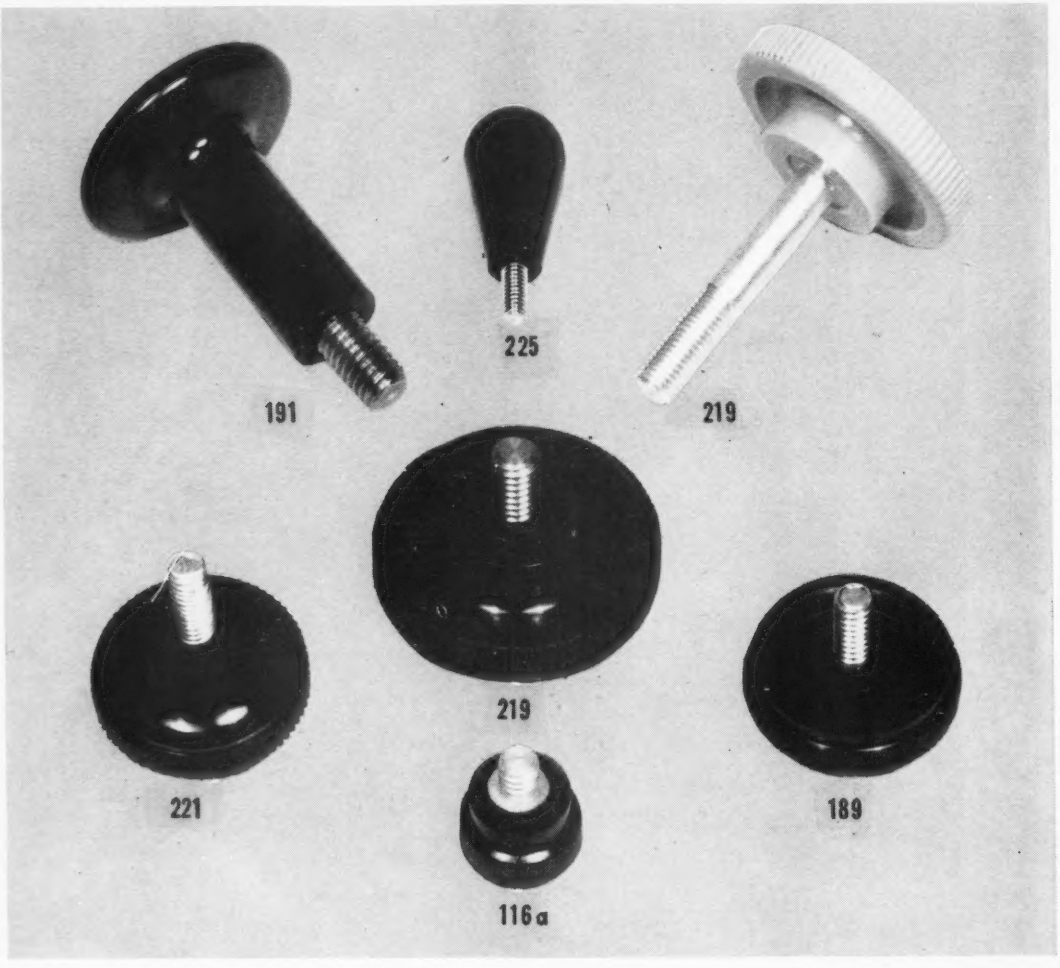
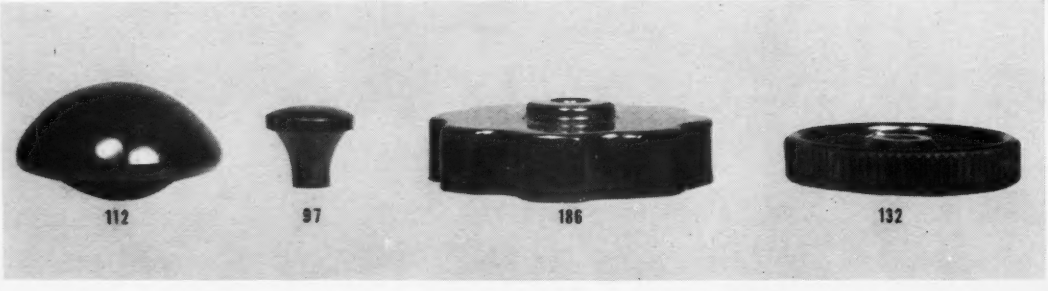
Design Engineering DATA SHEET





knob types

The article in last month's issue of this magazine on hand controls created so much interest that we are giving on this spread details of some of the many knob types made by Dimco-Gray Co.

They have a wide selection of standard molded parts available including many designs not shown here.

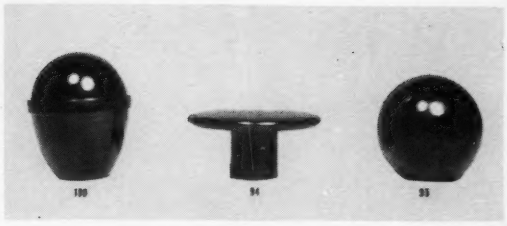
Of those shown on this spread, here are some of their suggested applications: **94:** Lid or pull knob suitable for cooking utensils, appliances: **95**: Ball knob (gear shift levers and so forth). **97:** Lid knob. **112:** Mushroom knob (available with brass insert). **116A:** Knurled thumbscrew. **124:** Fluted instrument knob used as adjusting knob on instruments and control panels. **132:** Knurled handwheel—a tuning wheel for electronic equipment. **145:** Tapered handle. Heavy-duty grasp for machine tools. **180:** Oval knob. **186:** Fluted handwheel, heavy-duty for valves and control shafts. **189:** Agitator cap suitable for washing machines. **190:** Tapered handle—a medium-duty grasp. **191:** Push-pull knob (heavy-duty). **207:** A popular decorative instrument knob for use on electrical instruments. **218:** Heavy-duty knurled knob. **46A42256:** Bar knob (¼ in. shaft hole with brass bushing). **47A40527:** Slant arrow knob.

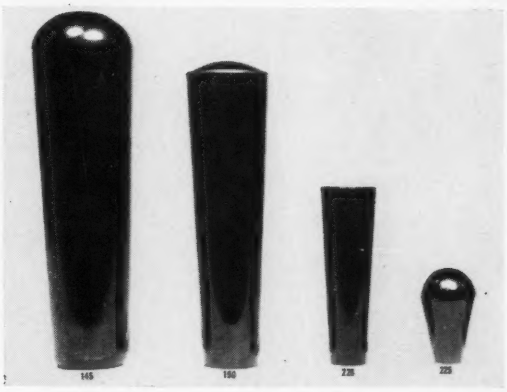
Minor change (inserts, spreads, color and so on) can be made on these stock parts to suit individual requirements. They also have available complete mold-making and protection facilities for custom-designed parts.

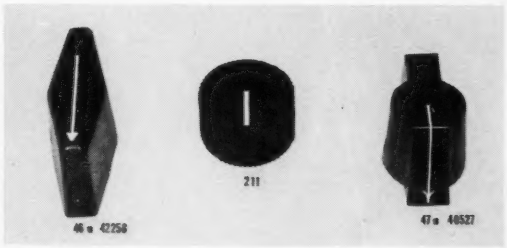
For application requiring above-average physical properties, the knobs can be molded of various special material. Some of these characteristics include: heat resistance up to 500F, high strength, electrical properties, low friction or resistance to chemicals.

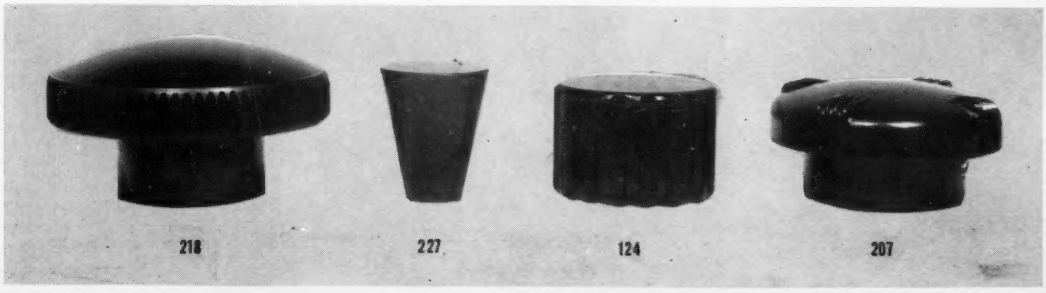
Most of the stock knobs are available with a variety of standard molded-in, tapped brass inserts and practically all can be modified to accommodate special metal inserts having male or female threads, plain protruding studs or counter bores.

Ring Reader Service Card No. 200 for further details.



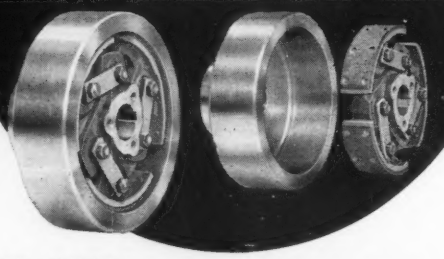






Flexible ACTION IN THE *New* HILLIARD TWIFLEX

AUTOMATIC CENTRIFUGAL CLUTCH COUPLING



11 *NEW* IMPORTANT FEATURES . .

1. Flexible in all directions.
2. Absorbs Shock.
3. Limits torsional vibration.
4. Has adjustable idle speed
5. Can be furnished in automatic free-wheeling type.
6. Smooth starting.
7. No slip under normal load at full speed.
8. Protects driver and driven mechanisms against overload shock.
9. Can be furnished in automatic backstop type.
10. Prevents torsional resonance.
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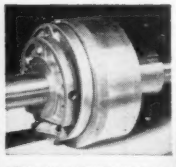

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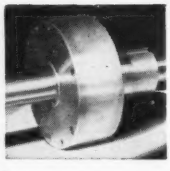

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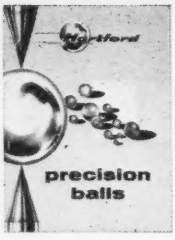

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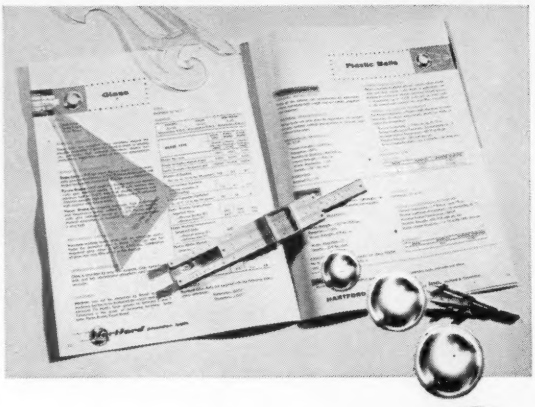

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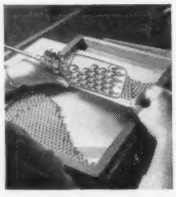

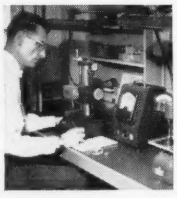

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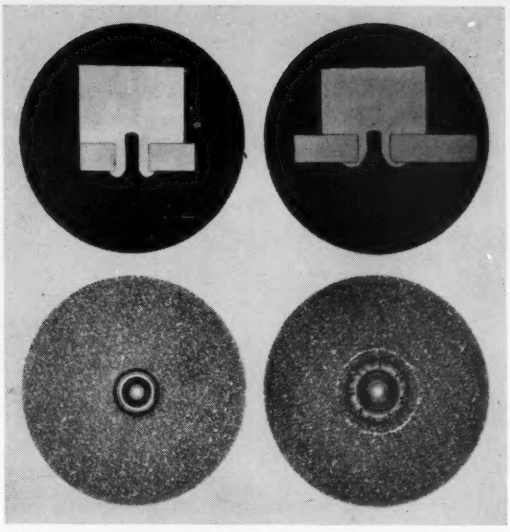


Neat appearance of the cleat at left contrasts with the split rim made by the old-style method at right.

Cleating: a riveting method

The electronics industry uses it

Cleating is a method of riveting widely used in the radio and electronics industry. Its object is to make a mechanical joint between two or more parts, for example between a bush, hub or nut (the cleat) and one or more plates or strips. The cleat has a cylindrical rim which (after it has been pushed through a hole in the plate or strip) is forced outward by means of a special tool, thus completing the joint. The method is illustrated in Fig 1.

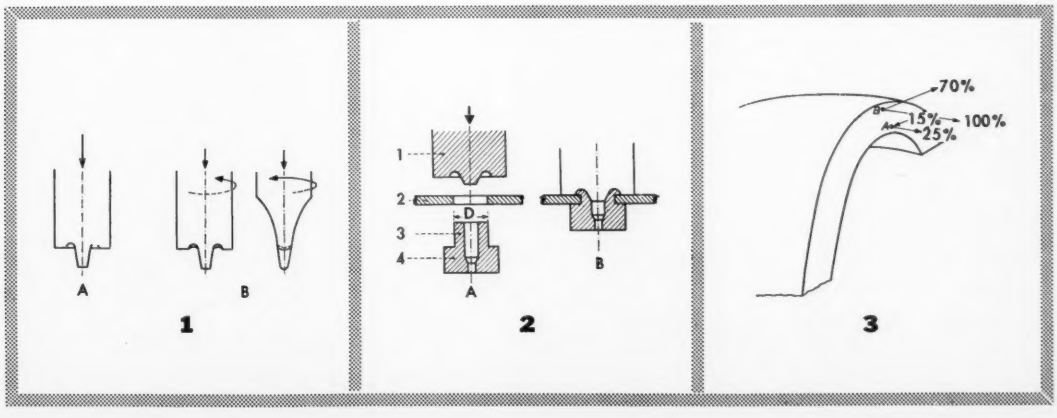
Cleating can be carried out in two ways: by direct pressure or by applying pressure with the tool spinning. The appropriate tools are represented in Fig 2. In the spinning method, the tool rotates at a speed of several hundred rpm. This requires less pressure than the direct pressure method, an important consideration with brittle materials (such as ceramics or plastics), but it takes longer to make the joint.

The requirements of a cleated joint are based on mechanical strength and appearance. In the process there is a danger that both the strength and appearance of the joint will suffer owing to the occurrence of cracks in the rim. (Corrosion may be another cause, but this will not be considered here.)

In view of the extent to which the rim of the cleat is plastically deformed during the making of the joint, the occurrence of cracks is not surprising. In the case of a rim of diameter d = 4 mm [Fig 1 (a)], a radial compression of about 15% occurs at point A in Fig 3, and a tangential elongation of about 25%. At point B, there are radial and tangential elongations of as much as 70% and 100% respectively. That the metal can withstand this plastic deformation is due to the introduction (during the cleating process) of compressive components which act at right-angles to the tensile components. (An analogous state is produced in deformation processes such as cold-rolling and riveting.)

The cleat and the tool have therefore been re-designed so that there is a smaller tangential deformation and (at the same time) a greater pressure radially. This means keeping the material of the rim more bunched together. The profile of the tool was modified accordingly.

(Information taken from an article by Deelman in "Philips Technical Review," p. 268, vol. 19, 1957/58.)



New products & materials

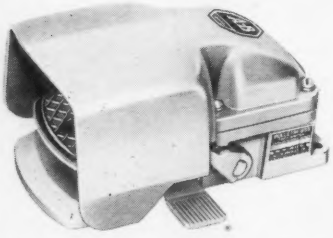
continued

the need for a large crank or other space-consuming unit. The knobs spin down on the work with flick of a finger and tightens with a bar or tool handle. (222)

Heavy-duty foot switches

A redesigned line of heavy-duty foot-operated switches to meet a greater variety of operating needs has been announced by **Allen-Bradley Canada Ltd.**

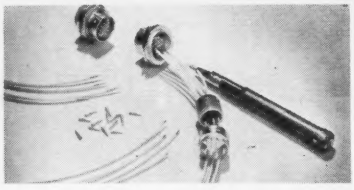
The foot switch base and cover are sturdy, lightweight aluminum die castings. Three different styles are available



to provide a guard extending over the top of the foot treadle, a guard covering the top and sides of the treadle, and an open treadle. The broad treadle is easy to reach and is placed close to the floor to minimize operator fatigue. The base has been extended so that the switch cannot be tipped by stepping on the treadle or the treadle guard, also eliminating the need for bolting the switch to the floor. (223)

Miniature electrical connector

Taper-pin receptacles replace the solder-pots in a newly developed miniature enviromental electrical connector manufactured by the **Deutsch Co.** This taper-contact connector is available in 3, 7, 12, 19, 27, 37 and 61 contact arrange-



ments. All plugs in this series are available with push-pull mechanism. (224)

Magnet wire

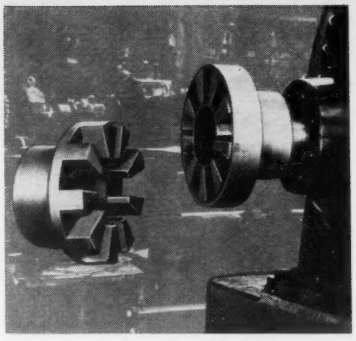
Daglas magnet wire — a new product offering greater flexibility, superior adhesion and resistance to surface abrasion — is being manufactured by the **H. K. Porter Company (Canada) Ltd.**

This wire is manufactured by wrapping bare or enameled copper wire with

a combination of Dacron and glass fibres, and then heating to fuse the glass fibres in place. An over-all coating of varnish is applied, providing a smooth finish and abrasion resistance. (225)

Heavy-duty flexible couplings

A complete line of flexible couplings by the **Lovejoy Flexible Coupling Co.** is now being offered in sizes to 4250 hp and over. They feature quick installation and easy alignment. Connection to driving and driven shafts can



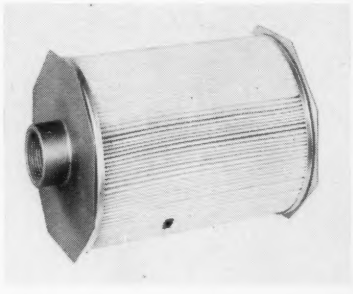
be made in minutes. Alignment is so simple that it can be accomplished with a straight edge. Gauges are not required.

With bore sizes ranging to 9½ in., the couplings are especially constructed for the most rugged types of service. Bodies and jaws are machined electric steel or nodular cast iron. No complicated mechanisms or intricate parts are used. The load is entirely transmitted through compression of individual load cushions. This not only eliminates wear on the metal jaws, thus substantially increasing coupling life, but also permits reversal or advancing of cushions on nonreversing loads to double cushion life. (226)

Hydraulic oil filter

Kahn and Co. has recently introduced to users of hydraulic equipment a micronic in-tank filter assembly. This filter assembly is available in three models with rated flow rates of 7.5, 15 and 30 gpm.

The use of resin-impregnated cellulose in an accordion-pleated cylindrical configuration exposes the largest surface



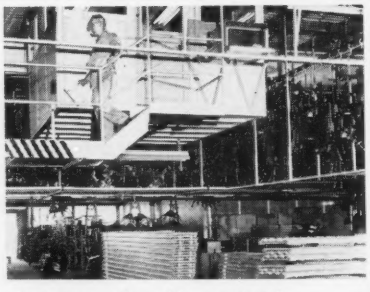
area possible. This results in a highly effective filtering action of particles 10 microns or larger.

Another important design feature is the all-stainless steel fabrication of the filter mounting structure. The hydraulic system is thus protected against contamination from the filter assembly itself.

Filtered flow rates of any desired amount can be obtained in hydraulic systems by using a suitable combination of the filters arranged in parallel. (227)

Office Overhead

Here is an idea used in the Plymouth plant of the Rapistan Co. The office has been raised up to about 10' above the floor. This gives an additional 120 sq. feet of floorspace for storage. Also note in the background at ceiling level, overhead storage suspended from ceiling — and Rapistan-Keystone overhead storage and accumulating conveyors for storing Rapistan stands and curves. Write for com-



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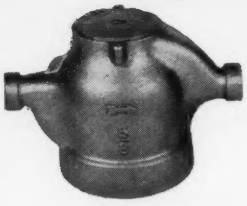

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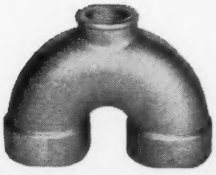

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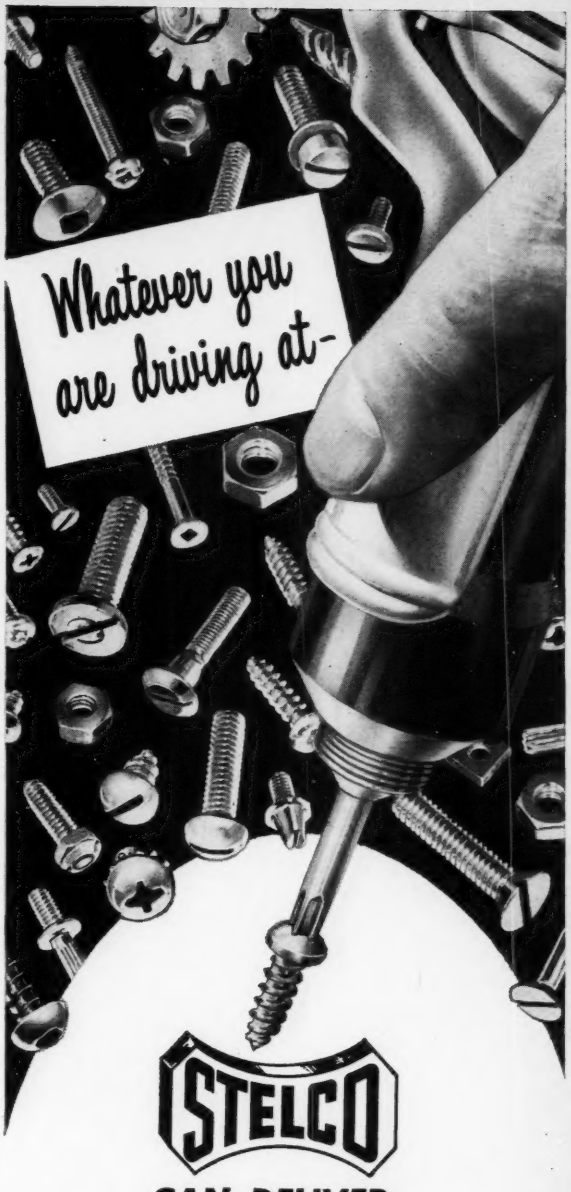

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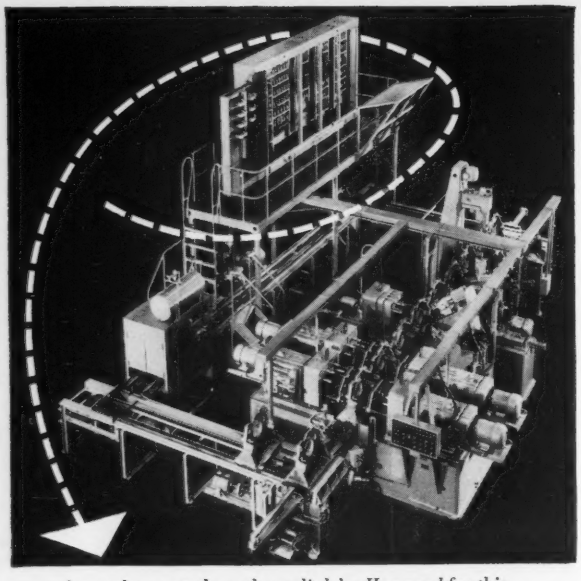

A complex control panel supplied by *Hammond* for this automation equipment built by Standard Modern Tools Ltd.

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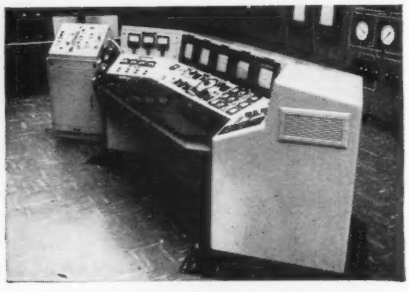

A Hammond built control console in use at Atomic Energy of Canada, Chalk River.

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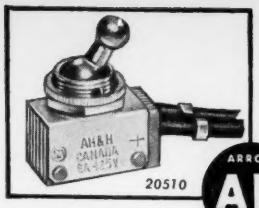

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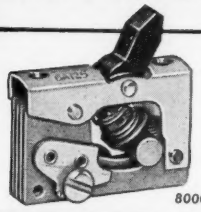

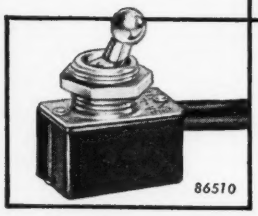

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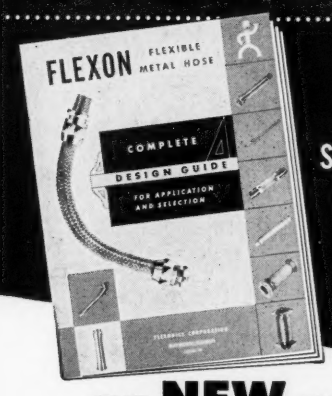

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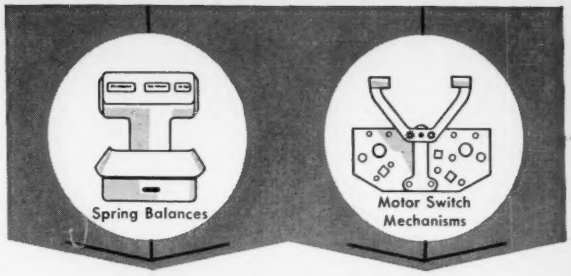

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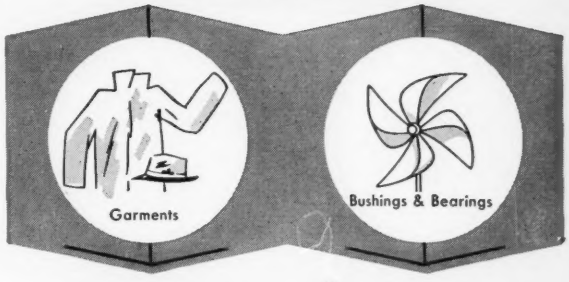

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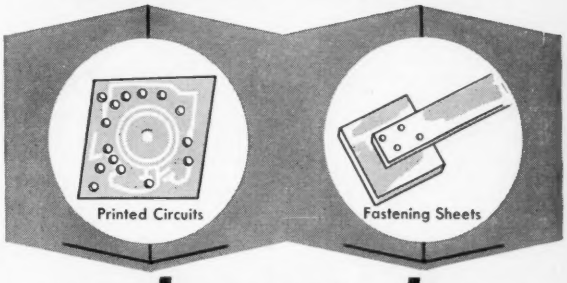


and costs less

when you use

UNITED EYELETS

United's STANDARDIZED EYELETS — comprising more than 60 different eyelet sizes — answer a need of the industrial user and designer for an orderly, simplified method of determining which eyelets will meet their specifications.

Efficient and economical to use, United's STANDARDIZED EYELETS, are readily adaptable as fasteners, reinforcements, decorations, pivots, bushings or any combination of these uses.

UNITED has eyelets especially suited for fabric work, paper and card work and for articles such as window shades, belts, corsets, games and an infinite variety of uses.

Contact a USMC field technician to help you solve your problems right on the job. Stocks carried for quick delivery.

CUSTOM EYELETS made to your specifications.

57-1

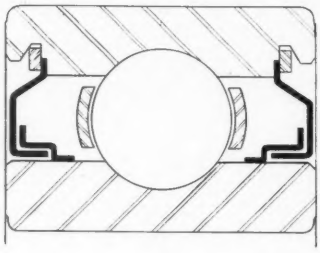
UNITED SHOE MACHINERY COMPANY
of CANADA Limited
MONTREAL TORONTO GALT QUEBEC

Ball bearing: slinger action circulates the lubricant

Cartridge ball bearings with dual labyrinth seals that hold a lifetime supply of lubricant (and employ a "slinger action" to circulate the lubricant for maximum performance) are a development of Hoover Ball and Bearing Company.

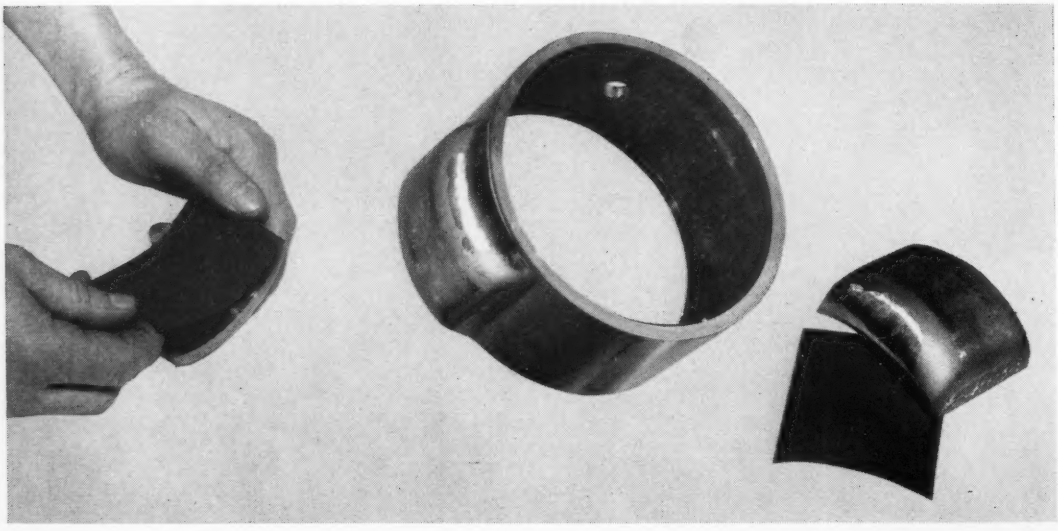
Designed to standard double-row widths, these bearings have extra-large reservoirs to hold the lubricant, which is applied at the factory. Dual labyrinth seals (which lock in the lubricant) are formed by an inner and outer shield, fitted to create both a horizontal and a vertical labyrinth. Running tolerances are so close that there is no chance for lube to escape or for dirt to enter the bearing. The inner shield, rotating with the inner raceway of the bearing, provides the centrifugal force that "slings" lubricant again and again to the working surfaces, regardless of bearing position.

Precision made, the bearings feature high load capacities, quiet operation and carry radial or thrust loads in either direction. Installation and replacement problems are simplified, because bore and outside diameter are the same as standard single row bearings.



(366)

Flexible brazing sheet: less cost in large contact areas



Flexible sheet stock is the latest form in which Nicrobraz brazing alloys are available, according to an announcement from stainless processing division of **Wall Colmonoy Corporation.** The new material, available in flexible sheets from 0.015 to 0.060 in. thick, is recommended for use in brazed laminated sections and sandwiches of stainless steel, high alloys and titanium.

This sheet stock can reduce costs where large contact surface areas are involved. Laboratory tests and pilot production applications indicate that the material has flow and wetting properties equal to those of conventional brazing alloy forms.

Brazing alloys now available in sheet form are the standard LM and LC and Nicrobraz 10, 30, 45, 50, 60, 130 and 150. Sheets are available for all thicknesses in widths from 2 in. to 2 ft. Widths up to 1 ft are available in lengths up to 6 ft. Widths above 1 ft are available in lengths up to 2 ft. (367)

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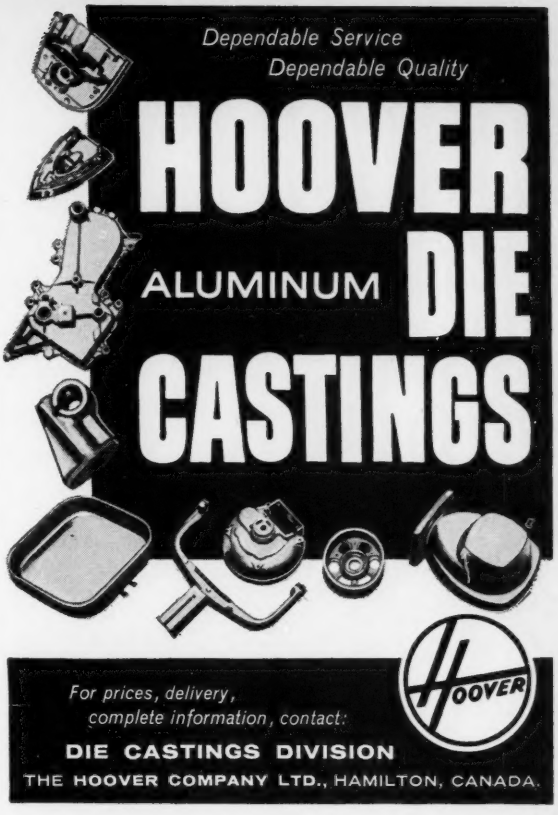

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A challenging job opportunity on the editorial staff of DESIGN ENGINEERING

Some writing ability is required and an engineering degree is preferred, but not essential. The job includes stimulating contact with industrial firms, and provides training in editing and layout design. Progress for the right man is assured. Salary depends upon experience.

Please send written resume to

The Editor
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Toronto, Ont.

Editorial

Aluminum pressure vessels studied

Within the last few years, considerable progress has been made in the use of aluminum pressure vessels, vessels, that is, operating at a pressure significantly above or below atmospheric. There is a growing need for such vessels in mechanical engineering, when it is important to have lightness, good low-temperature properties and certain types of corrosion resistance.

This month, the Institution of Mechanical Engineers, with the co-operation of the Aluminium Development Association (and others) is consequently holding (in London, England) a symposium on their design, manufacture and use.

There are good reasons behind this, for very little information about them has so far been published in Britain and there are still many problems connected with aluminum pressure vessels that need attention and study. A knowledge of these problems is available in certain instances, but it is not yet widely disseminated and a symposium of this sort should help to correlate such knowledge.

The number of papers to be offered will not be large, but they will cover the main aspects of the subject: a survey of codes of practice in other countries; basic properties of the aluminum alloys available; methods of fabrication; and experience in the use of aluminum pressure vessels, with case histories where available. In all the papers, stress analysis and design will be kept well to the fore.

Naturally, there will be the usual break for tea!

Basic training:

According to Ronald M. Robinson, vp of Canadian General Electric (in a recent address to the American Vocational Association), the grounding students receive at secondary technical schools in mathematics, physics and English does not fit them for industry.

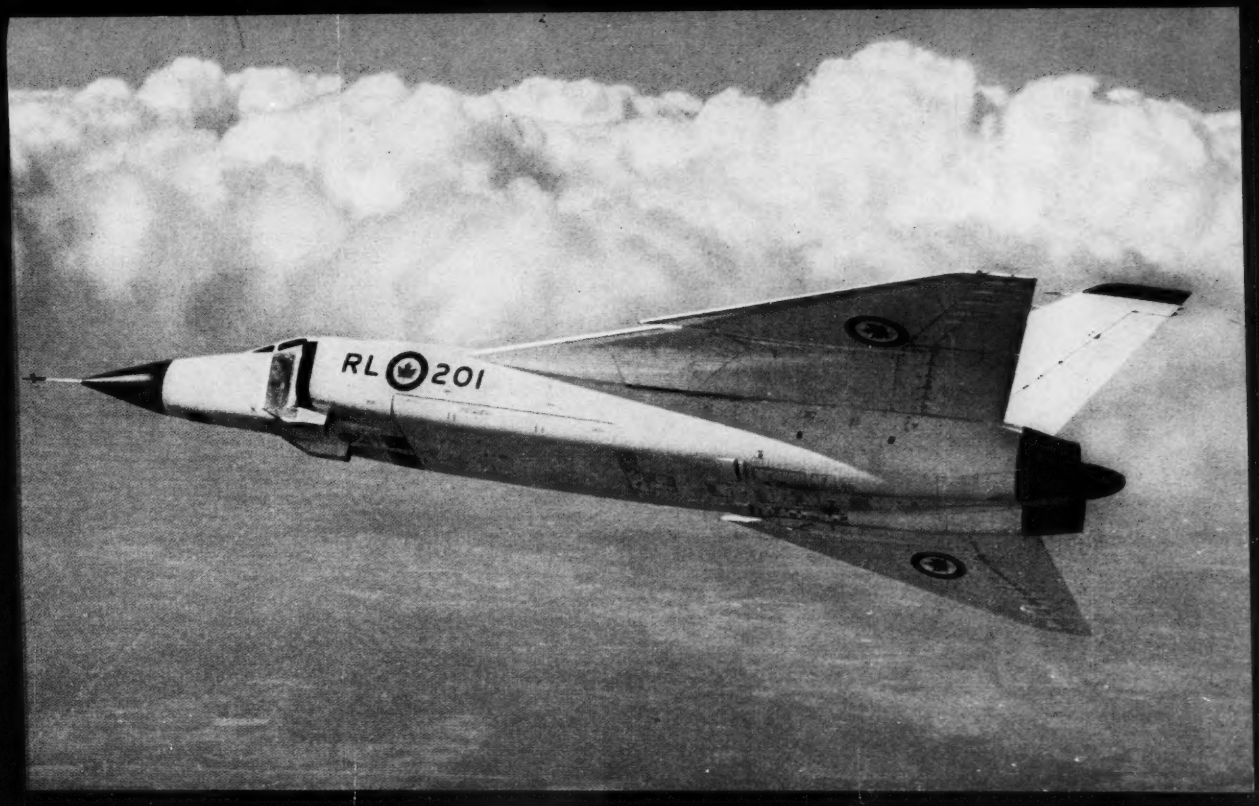
In his opinion (and we agree), the vocational schools should teach more basic theory, so that graduates could later specialize in one particular branch of engineering.

Enquiry time saver:

The information plates used at the last Design Engineering Show in Chicago (commented on by us editorially in the April issue) were so successful (mainly because they cut out the hazard of illegible handwriting) that the ASTE decided to use them at the Western Tool Show in Los Angeles. They take the form of Inquiry Time Saver metal plates, embossed with the visitor's name, address, title and company.

Engineers will now get the information they want, even if they can't write.

William Morse.



▲ The Avro Arrow is shown in flight during test manoeuvres over Ontario.

The Arrow weapon system is a bomber-destroyer having supersonic mission capabilities. ▼

The Avro Arrow is as big as a World War II bomber yet took off on its first flight in only 3,000 feet of the 11,000 foot runway at Malton. ▼

AN ARROW IN THE SKY

Since its first flight on March 25th, the Avro Arrow has been meeting the vigorous demands of its extensive flight test program. Proceeding according to plan, the Arrow flew faster than sound on its third flight, and more than 1,000 miles per hour on its seventh flight.

AVRO AIRCRAFT

AVRO AIRCRAFT LIMITED

MALTON • CANADA

MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken bearings

PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

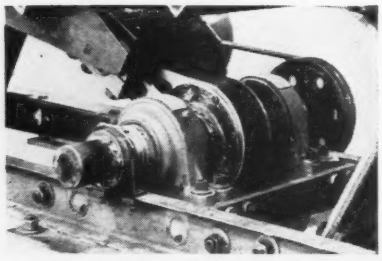
Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface —never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

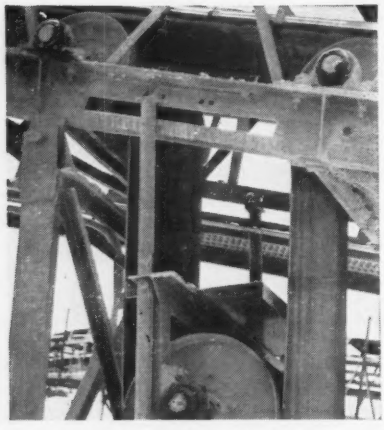
And to get the finest steel for Timken bearings, we make it ourselves. So specify bearings trade-marked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio, U. S. A. **CANADIAN PLANT:** St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

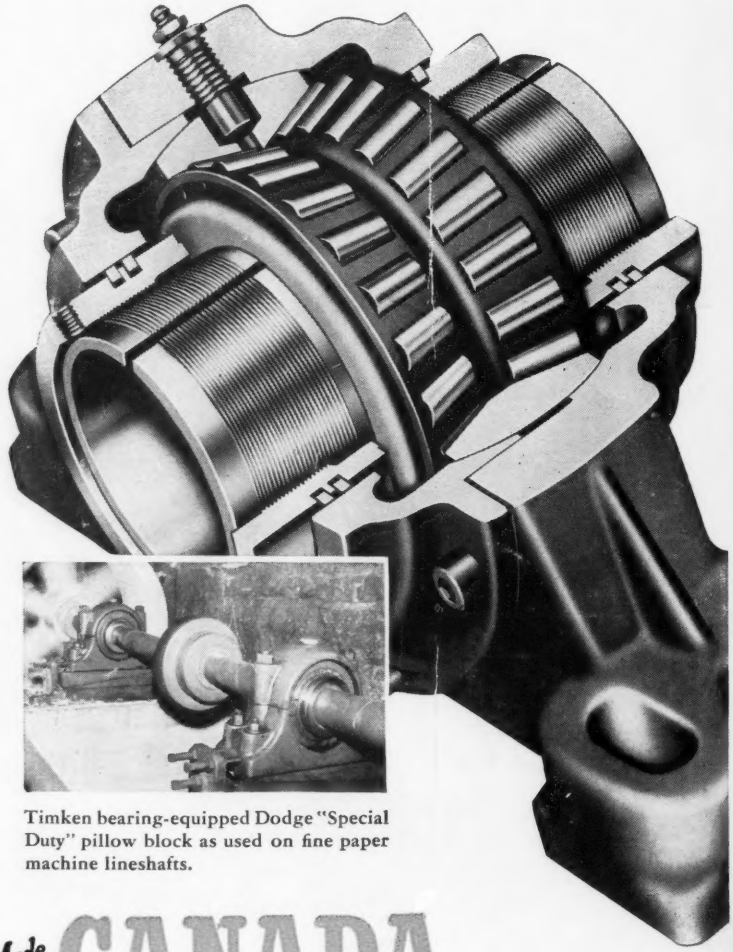
This symbol on a product means its bearings are the best.



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.



Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.



Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

TIMKEN *Made in* **CANADA**

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TAPERED ROLLER BEARINGS